

U. S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
JULY 2004

STATEMENT OF FINDINGS
FOR THE 2004 EXPERIMENT
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
AND
FINDINGS OF NO SIGNIFICANT IMPACT
AND
FINDINGS OF 404(b)(1) GUIDELINES COMPLIANCE

1. The purpose of the experimental mussel relocation method is to determine if this technique might be considered an alternative to the current practice of hand collection and relocation by divers in moving freshwater mussels. When encountering large numbers of mussels (hundreds of thousands) an expedient, efficient, timely, holistic and safe approach, for both mussels and divers, needs to be considered. This experiment is designed to determine if this alternative method might be a feasible tool to add to freshwater mussel conservation measures using mussel relocation.

2. The U.S. Army Corps of Engineers, Nashville District, and Cooperating Agency, the Tennessee Valley Authority, propose to perform an experimental mussel relocation method employing a clamshell dredge and split-hulled scow to move freshwater mussels. The proposed experimental site would be located between Tennessee River Miles 194.0 and 195.0, upstream of Crump, Tennessee in Hardin County. The proposed experiment consists of removing approximately 100 cubic yards of sand and gravel containing freshwater mussels. Two different dredge bucket treatments would be evaluated in removing river substrate. Treatment 1 would use partially full dredge buckets, and treatment 2 would use full dredge buckets. This material would be transported by dump scow and disposed in an open water placement site. Approximately one-half acre of river substrate would be disturbed by the experiment, which will occur within a river segment currently permitted for commercial sand and gravel extraction and mussel harvesting. Commercial mussels are the targeted test organisms.

3. An Environmental Assessment (EA) has been prepared by Ms. Joy Broach. This document was written as directed by the National Environmental Policy Act (NEPA), Council for Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR, 1500-1508), and Corps of Engineers Regulations (ER) 200-2-2 *Environmental Quality - Policy and Procedures for Implementing NEPA* (33 CFR, 230), and ER 200-1-5 *Environmental Quality - Policy for Implementation and Integrated Application of the U.S. Army Corps of Engineers (USACE) Environmental Operating Principles (EOP) and Doctrine*. The EA describes existing conditions, and evaluates potential impacts associated with both the Proposed Action (Implement the Experiment) and No Action alternatives. The "No Action" alternative would maintain the status quo of the current hand collection and relocation method by divers. The EA also considers the cumulative effects of freshwater mussel relocations. These include major changes in community structure in both the impact and relocation sites. Some mussel mortality is expected during any relocation effort. Factors that may affect mussels include handling, overcrowding in the relocation site, unsuitable new habitat, timing, burial, or mussels left behind in the impact site. The expected cumulative effect of any relocation effort would be to sustain current populations or augment or re-establish populations within historic ranges.

4. On July 31, 2003, Joint Public Notice No. PM-P 03-02 describing the proposed experiment, circulated to members of the public and to agencies with jurisdiction by law or special expertise. Issuance of this Joint Public Notice satisfied coordination under Section 401 and 404 of the Clean Water Act and scoping requirements under NEPA. The U.S. Fish and Wildlife Service (USFWS), Tennessee Wildlife Resources Agency (TWRA), Tennessee Department of Environment and Conservation (TDEC), U.S. Geological Survey (USGS), and Tennessee Valley Authority (TVA) have been involved in the development of this experiment. These agencies helped redesign the experimental protocols to acquire high quality and sound scientific data needed to evaluate this experimental mussel removal method.

5. The 2004 experiment has been coordinated through consultation with the U.S. Fish and Wildlife Service and the Tennessee Wildlife Resources Agency to minimize impacted to listed mussel species. On November 10, 2003, the USFWS issued a Biological Opinion and concluded that the 2004 experiment was not likely to jeopardize the continued existence of federally listed

species nor destroy or adversely modify any critical habitat. It also stated that requirements under the Endangered Species Act (ESA) and the Fish and Wildlife Coordination Act (FWCA) had been met.

6. Section 106 of the National Historic Preservation Act of 1966 requires that Federal agencies take into account the effects of its undertakings on historic properties included in or eligible for listing in the National Register of Historic Places. By way of correspondence dated June 9, 2003, the State Historic Preservation Officer (SHPO) concluded that no significant cultural resources were found within the proposed experimental site. In accordance with 36 CFR 800.16(y), the proposed activity is an undertaking with no potential to affect historic properties.

7. The 2004 EA did not reveal any significant onsite impacts resulting from implementing the 2004 experiment. There would be a short-term impact to water quality due to increased turbidity at both the dredge and disposal sites. However, this increase is not expected to exceed Tennessee Water Quality Standards. The State of Tennessee issued Water Quality Certification pursuant to Section 401 of the Clean Water Act on March 10, 2004. At this point in time, all issues regarding the experiment have been resolved.

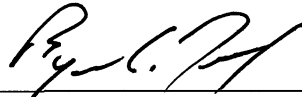
8. Additional agency coordination and environmental compliance has been met under the following laws, regulations, and Executive Orders: Clean Air Act and Clean Air Act Conformity Rule, Hazardous, Toxic and Radiological Wastes (HTRW), TVA Act, Floodplain Executive Order, Wetlands Executive Order, and Environmental Justice Executive Order.

9. The proposed 2004 experiment would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation, commercial fishing and musseling, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability, and recreational, aesthetic and economic values would not occur.

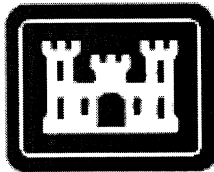
10. I have reviewed the EA for the proposed 2004 experiment, and responses to Public Notice No. PM-P 03-02. I have evaluated the proposed disposal of dredged material in accordance with the guidelines promulgated by the Administrator of the Environmental Protection Agency pursuant to Section 404(b)(1) of the Clean Water Act. Based on that evaluation, I have determined that the discharge of dredged material, and placement of the dredged material associated with the proposed 2004 experiment is specified as complying with the Guidelines. Also, I have determined that the work would not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Accordingly, I have concluded that an Environmental Impact Statement covering the proposed work is not required. Finally, having weighed the potential benefits that may be accrued as a result of implementing the 2004 experiment against the reasonably foreseeable detrimental effects, I have concluded that the proposed 2004 experiment as set forth in the EA would be in the public interest.

13 JUL '04

Date



Byron G. Jorns
Lieutenant Colonel
Corps of Engineers
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US Army Corps of Engineers

Nashville District

ENVIRONMENTAL ASSESSMENT

Experimental Mussel Relocation Method
Tennessee River Mile 194.0 – 195.0
Hardin County, Tennessee

June 2004

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EXPERIMENTAL MUSSEL RELOCATION METHOD
TENNESSEE RIVER MILE 194.0-195.0
HARDIN COUNTY, TENNESSEE
JUNE 2004

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1.0 INTRODUCTION

1.1 Authority

The Rivers and Harbors Act of July 3, 1930 (46 Stat. 927) authorized permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth of the river to Knoxville, Tennessee. The Tennessee Valley Authority Act of 1933 (16 U.S.C. §§ 831-831ee) authorized TVA to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the TVA Act, the Corps of Engineers, in cooperation with TVA, has maintained navigation channels on TVA projects by performing necessary maintenance dredging operations. This division of responsibility is outlined in the October 26, 1962 *Memorandum of Agreement between the Department of the Army and Tennessee Valley Authority for Construction, Operation, and Maintenance of Navigation Facilities on the Tennessee River and its Tributaries*. This MOA assigns responsibility for maintenance of the main navigation channel to the Department of the Army, and provides that TVA will be responsible for new facilities and recreational navigation channels. Maintenance of an open channel is considered part of TVA's statutory mission. TVA is a cooperating agency in the preparation of this Environmental Assessment (EA).

This EA is being prepared in accordance with the Council On Environmental Quality Regulations (40 C.F.R. 1500-1508) and Engineer Regulation ER 200-2-2, Procedures for Implementing NEPA. The National Environmental Policy Act (NEPA) is our basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail. The Corps' seven environmental operating principles (ER 200-1-5) have been incorporated during the planning and design phases of this project, and will continue to be used as a guide during implementation and assessment.

1.2 Purpose and Need for Action

As noted above, the Rivers and Harbors Act of 1930 and the Tennessee Valley Authority Act of 1933 require that a safe navigable channel be maintained between the mouth of the Tennessee River and Knoxville. Engineering Manual EM 1110-2-1611 specifies that to maintain safe two-way traffic, the channel must be a minimum of 300 feet wide at all points and must be a minimum of 500 feet wide in the bends. Shoaling is monitored using bathymetric surveys. The 2004 Tennessee Valley Authority Reservoir Operations Study – Final Programmatic Environmental Impact Statement (TVA, 2004), states that “The Tennessee River navigation system provides for a year-round channel with a minimum depth of 11 feet between Knoxville and Paducah and on several tributaries. The 11-foot channel provides the 9-foot navigation depth mandated by the TVA Act plus a 2-foot margin of safety.”

TVA conducted a mussel survey in 1999 in preparation for required maintenance dredging in the Diamond Island area. Although the area had been dredged seven times previously, TVA found that the area contained in excess of one million mussels including several endangered species. Normally, for small areas, divers search and relocate mussels by hand. Hand removal is labor

intensive and is both inefficient and expensive. Based on the number of mussels and area to be searched it became obvious that an alternative to diver hand relocation should be considered to reduce unnecessary cost and because hand relocation can leave many mussels behind.

This experiment was formulated to determine if relocation by mechanical means could be an acceptable alternative to hand relocation in some, limited applications. This EA pertains only to the exercise of this experiment. It is not intended to authorize future dredging operations. Future operations would have to be evaluated separately on a case-by-case basis just as they are now.

1.3. Background

The Tennessee River navigation channel, adjacent to Diamond Island, has been an area of recurrent sediment accumulation. This site has been dredged seven times since 1953. On four projects, the disposal site was located in the back chute and at the head of Diamond Island on the right descending bank (USACE, 1975). On two projects the disposal site was located in the back chute near the toe of Diamond Island on the right descending bank. A portion of the site was last dredged in 1992. The disposal site was located in the upper back chute of Wolf Island on the right descending bank.

On January 25, 1999, Joint Public Notice No. 99-11, File No. COE-162 was released. It described proposed maintenance dredging at Diamond Island. Following public review and initiation of the dredging EA, field data collected by the Tennessee Wildlife Resources Agency (TWRA) showed that diverse mussel populations had colonized past disposal sites and the proposed dredge site. A Tennessee Valley Authority (TVA) mussel survey estimated a mussel population of over one million. The Corps suspended further action. If the mussels could not be avoided, then the impact needed to be minimized by removing the mussels out of the action area. Mussel relocation is considered a conservation and management tool in large rivers (Cope and Waller, 1995).

The current mussel relocation method uses divers to hand remove and relocate individual mussels. Time, experience, labor, funding, area impact size, visual and tactile searches, and hand-excavation are all realistic and practical limitations that affect the collection effort (Strayer and Smith, 2003). Depending on the limitation, an unknown number of mussels remain in the impacted area. Relocated mussels may be stressed during collection, handling, transport and placement activities, which ultimately affects the relocation success (Cope and Waller, 1995; Dunn et. al., 1999; Salazar and Salazar, 2000; Strayer and Smith, 2003).

Mussel relocation success is also dependant on relocation into appropriate substrate. Dunn et. al. (1999) found that locating suitable habitat in a relocation site was the most important factor affecting mussel recovery rates. Even small changes in the physical habitat may prevent adult mussels from adapting in the new relocation (Cope and Waller, 1995). One possible option to minimize this effect would be to relocate mussels with some of their original habitat. Payne et. al. (1989) investigated four disposal piles placed in an island back chute. The 1988 pile contained no mussels, however the 1972 pile had greater diversity and density than a reference site just upstream. While it is not clear if the mussels came with the original material, or dropped into the pile as juveniles, the effort suggests that removing habitat that supported mussels in an

original location, might support mussels in a new similar location. According to Watters (1999) more testing is needed evaluate the effects of dredge spoil on mussels.

Mussel relocation in large deep rivers requires scuba divers. There is always the risk of injury or possible death due to human error, or safety considerations such as high flows, poor visibility, and diver fatigue. Strayer and Smith (2003) note that for deep lakes and rivers, visual searches and hand excavation, do not work very well in these waterbodies. They further note that the mussel resources could benefit from consideration of remote methods using grabs and dredges.

In large beds containing hundreds of thousands of mussels, diver relocations are limited. A timely, efficient, safe (for both the mussels and divers) and economical method of mussel removal needs to be considered. The experimental mussel removal method was developed to address large mussel populations and the factors that affect relocation success previously identified. However, its consideration as a possible relocation method would require field-testing, which is the subject of this EA.

On April 29, 2002, the Corps met with representatives from TWRA, TVA, and the U.S. Fish and Wildlife Service (USFWS). Mussel relocation methods, and factors affecting a relocation effort (removal efficiency, timeliness, diver and mussel safety, and funding) were discussed. During this meeting the Corps proposed an experimental mussel relocation method as an alternative to hand collection and relocation by divers. The proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging, was prepared by malacologists from the U.S. Army Engineer Research and Development Center (ERDC). This experimental method used a clamshell dredge, split hulled dump scow, and modified operating techniques to relocate mussels. The protocols for conducting this experiment were reviewed during this meeting.

An EA was prepared for this initial experiment (Environmental Assessment, Experimental Mussel Relocation, Tennessee River Mile 194.0-195.0, Hardin County, Tennessee, September 2002). The Finding of No Significant Impact (FONSI), Statement of Findings, and Findings of 404 (b)(1) Guidelines Compliance, were signed on September 7, 2002. The ERDC proposal was an appendix to the EA. The initial experiment was conducted on September 17, 2002.

It was recognized that the protocols in use during the initial experiment were insufficient. There was no Quality Assurance/ Quality Control (QA/QC) procedure in place to verify the content of the excess sand and gravel tossed off the barge as the dredge bucket scoop material was being processed. One bag of mussels collected from the bucket scoop material was not given to TWRA for identification and physical condition verification. Also, there was no procedure to evaluate the dredge bucket scoops on the river bottom for remaining mussels. In September 2002, TWRA suspended the experiment pending redesign of the experimental protocols.

On February 13, 2003, the Corps (Nashville District) met with TWRA, USFWS, TVA, and the U.S. Geological Survey (USGS) to request reinitiating the experiment, redesigning the experimental protocols, and assistance in field implementation. During this meeting, the agencies significantly redesigned the 2002 protocols to address field implementation and data quality and gaps issues. Major changes included detailed tasks, mark-and-recapture, QA/QC,

dredge bucket sieving process, and bucket scoop evaluations on the river bottom, and disposal depth in the placement site. Over all QA/QC will be entrusted to TWRA. The proposed redesigned protocols can be found in Appendix A.

On March 10, 2004 the Corps, requested a meeting with TWRA, USFWS, TVA, and USGS to discuss a field plan and coordinate field implementation. The experiment was rescheduled for the early fall to avoid fish and mussel spawning activities and to increase the likelihood of conducting the experiment under low river flows. A communication plan was developed to guide the experiment from data collection to compilation, analysis, internal review, and peer review prior to public review to ensure release of accurate information.

The proposed second experiment is located in Hardin County, Tennessee (Figure 1.). The experimental site is located just off shore along the left descending bank, between Tennessee River Mile (TRM) 194.0-195.0 (Figure 2.). This is the same experimental site used in the initial experiment.

1.4 Experimental Site Location

The proposed river reach (TRM 194-195) was selected to implement the experiment because it is currently permitted for commercial sand and gravel extraction. It was anticipated that mussels would be sparse in a significantly disturbed area. The last time commercial dredging occurred was in 2001 during exploration dredging to evaluate the quality of the river substrate for commercial use.

1.5 Experimental Site Setting

The surrounding countryside is primarily agricultural with large patches of wooded areas. The riverbanks are fairly steep. Large sections of the riverbank have sloughed into the river due to the highly erodible sand and gravel soils. The river banks bench up to a wide bottomland crossed by a number of creeks and sloughs.

Figure 1. Vicinity Map. Proposed project location near Crump, Tennessee, in Hardin County.

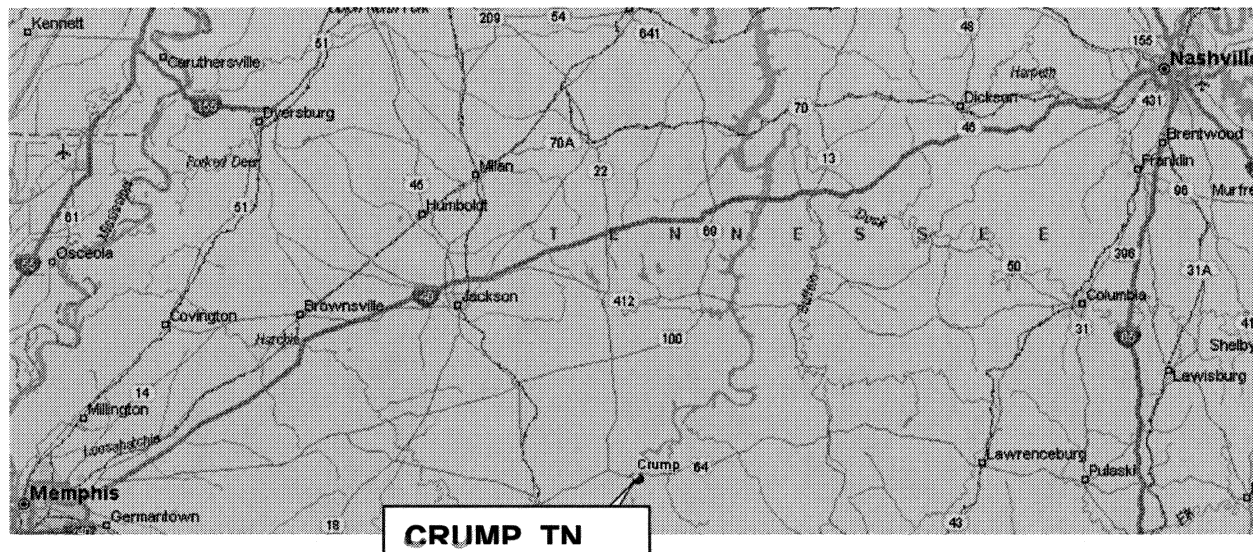
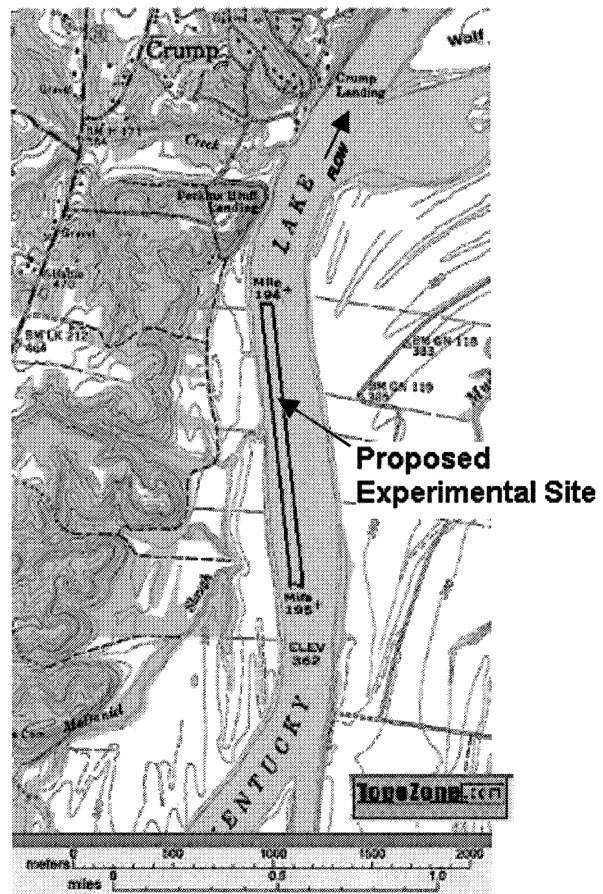


Figure 2. Experimental Site.

Location just upstream Crump, TN,
between Tennessee River Miles
194.0 and 195.0, on the Left
Descending Bank. .

USGS Topographic 7.5-Minute
Series Map: 13 NE
Pittsburg Landing, TENN, 1972



2.0 PROPOSED ALTERNATIVES

2.1 Alternative 1 - Proposed Action – Implement the Experiment

The proposed action is to implement the experimental mussel relocation method using the redesigned protocols (Appendix A). A clamshell dredge bucket would be used to scoop river substrate. Two bucket treatments would be used. One treatment would use full buckets. The second treatment would use partial buckets. The clamshell dredge bucket is designed to hold approximately 3 cubic yards (~600 gallons) of material. Test buckets would be placed on a flat barge, one at a time. Each bucket of material would be processed through sets of stacked graded screens with mesh sizes of 3, 1½, ½, and ¼ inch. A sub-sample of the washed fines would be sieved through a ⅛ inch screen to look for the presence of juveniles. Mussels would be picked from the screens and identified, counted, and measured by group size. Mussels would be inspected for markings or damage. Both bucket treatments would be used to place material in a single layer inside a dump scow for transport and placement in the disposal area.

Non-listed mussels would be used in a mark and recapture study. Marked mussels would be placed in the test dredge site. This study would provide an indication of bucket removal efficiency and track marked mussels from dredging to disposal. Differently marked mussels would be placed in the placement site prior to disposal. They would be re-checked some time after the experiment to provide some indication of burial effect.

Two monitoring events are planned for this experiment. The Corps has requested recommendations of time windows that would capture the effects of the experiment, but minimize the effects of outside influences such as commercial musseling and extremely high flows.

2.2 Alternative 2 - No Action

The 'No Action' alternative is not doing the experiment.

2.3 Environmental Commitments, Permits, Approvals, and Compliance.

2.3.1 Section 404, Clean Water Act (CWA) (33 U.S.C. 1344)

This experiment is subject to Section 404, CWA (33 U.S.C. 1344). A Section 404(b)(1) evaluation for discharges of dredged or fill materials into the waters of the United States, has been prepared (Appendix B). The evaluation found that the proposed discharge meets the requirements of the EPA Section 404(b)(1) Guidelines. The Corps of Engineers does not issue itself Section 404 permits, however, it does follow the same process as all other applicants, and therefore, the proposed project required a Public Notice and review.

2.3.2 Section 401, Clean Water Act (CWA), Water Quality Certification.

A Water Quality Certification (a.k.a. Aquatic Resource Alteration Permit) pursuant to Section 401, CWA, and pursuant to 33 USC 1341, was obtained on March 10, 2004.

2.3.3 National Pollutant Discharge Elimination System (NPDES) Stormwater Permit

An NPDES Stormwater permit is not required. The proposed action occurs in the river.

2.3.4 Endangered Species Act (ESA)

Section 7 of the ESA has been met. A Biological Opinion and Incidental Take was issued for the experiment on November 13, 2003.

2.3.5 Fish and Wildlife Coordination Act (FWCA)

Under the Act (FWCA - 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) Federal agencies are required to consult and coordinate water resource project proposals with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and State wildlife agencies. This effort allows a holistic assessment of potential aquatic and terrestrial impacts that could result with implementation of a federal action. Act requirements have been met and are documented in the Biological Opinion (November 13, 2003).

2.3.6 Wetlands Executive Order 11990

Executive Order 11990, Protection of Wetlands, requires Federal agencies to protect wetlands. No wetlands would be affected by this project.

2.3.7 Section 106, National Historic Preservation Act (NHPA)

Section 106 of NHPA of 1966 requires Federal agencies to evaluate the effects of their activities on properties included in or eligible for the National Register of Historic Places. On June 13, 2002, the Tennessee State Historic Preservation Officer (SHPO) certified that no such properties were within the experimental site.

2.3.8 Environmental Justice Executive Order 12898

Neither alternative presents a disproportionate adverse impact on minority, low-income households, or communities.

2.3.9 Clean Air Act (CAA) and Clean Air Act General Conformity Rule (CAACR)

The proposed experiment is subject to the CAA, as amended (42 U.S.C. 7401 et seq.). The proposed work would occur in an attainment zone for purposes of the CAAGCR. The requirements of 40 CFR Part 51, Subpart W, apply to the proposed action. Section 51.853 of the Subpart lists exemptions to the general conformity provisions. The experiment would not be considered regionally significant and would not exceed the specified emission rates within the attainment area. The proposed experiment would be considered to conform to the State Implementation Plan (SIP).

2.3.10 Hazardous, Toxic and Radiological Wastes (HTRW)

The river substrate material consists of inert cobble, gravel and sand. Because contaminants do not adhere to material of large grain size, testing for the 404(b)(1) Evaluation would not be required.

2.3.11 Resource Conservation and Recovery Act (RCRA)

The proposed project is in compliance RCRA.

2.3.12 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

No CERCLA sites were identified within the experimental site.

2.3.13 Farmland Policy Protection Act

The purpose of FPPA is to minimize the extent that Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. Implementing the experiment will not convert farmland to non-agricultural uses.

2.3.14 TVA Act

The proposed experiment is consistent with TVA's responsibilities under the TVA Act to improve the navigability of the Tennessee River. It is also consistent with TVA's Environmental Policy and Principles to practice responsible stewardship of the Valley's natural resources. Under NEPA, TVA is a Cooperating Agency for this experiment.

2.3.15 Floodplain Management Executive Order 11988

Executive Order 11988, Floodplain Management, requires federal agencies to evaluate and minimize impact on floodplains. This experiment would not affect the floodplain.

2.4 Summary Tables.

Table 1 depicts the status of the environmental commitments and necessary permits and approvals. Table 2 shows the environmental and economic impacts associated with each alternative. Table 2 is derived from § 122 of P.L. 91-611 together with various project specific concerns. Table 3 evaluates the occurrence of possibly significant impacts as defined by the National Environmental Policy Act, commonly referred to as NEPA (40 C.F.R. §1500-1508). NEPA allows for a Finding of No Significant Impact (FONSI) if a selected alternative will not cause a significant impact, either adverse or beneficial, in any of the ten parameters set forth in the table. The definition of significance and the source of the ten parameters may be found at 40 C.F.R. 1508.27.

Table 1 – Environmental Commitments, Permits, or Approvals

Environmental Commitment, Permit, or Approval	Status
Section 404, CWA	Complete
Section 401, CWA	Complete
NPDES Stormwater Permit	Not Applicable
FWCA	Complete
ESA	Complete
Wetlands Executive Order 11990	Compliant
Section 106, NHPA	Complete
Environmental Justice Executive Order 12898	Compliant
CAA and CAAGCR	Compliant
HTRW	Not Applicable
RCRA	Compliant
CERCLA	Not Applicable
FPPA	Not Applicable
TVA Act	Compliant
Floodplain Management Executive Order 11988	Compliant

Table 2 - Environmental and Economic Impacts

Environmental And Economic Impacts	Alternative 1 Implement the Experiment	Alternative 2 No Action
Air Quality	-	-
Noise	-	-
Water Quality	Minor Negative Effect	-
Natural Resources	-	-
Aesthetics	-	-
Community Cohesion	-	-
Public Facilities	-	-
Public Services	-	-
Employment	-	-
Tax Values	-	-
Property Values	-	-
Displacement of People	-	-
Displacement of Businesses	-	-
Farms	-	-
Comm. Growth	-	-
Regional Growth	-	-
Aquatic Resources	Minor Negative Effect	-
Shoreline Erosion	-	-
Economics	-	-
Wetland Impacts	-	-
Operation & Maintenance Cost	Minor Negative Effect	-
Threatened & Endangered Species	Minor Negative Effect	-
Cultural Resources	-	-
Traffic	-	-
Environmental Justice	-	-
Wildlife Resources	-	-
HTRW	-	-
Flood Control	-	-
Navigation	-	-
Recreation	-	-
Safety	-	-
Hydropower Generation	-	-

- = No Affect

Table 3 – Determination of Significance of Alternatives

Environmental And Economic Impacts	Alternative 1 Implement The Experiment	Alternative 2 No Action
1.) Will the alternative cause any significant effects, either beneficial or adverse?	No. Other mussel relocation methods exist.	No. The alternative maintains the status quo of mussel relocation methods.
2.) Will the proposed alternative significantly affect public health or safety?	No. Public health and safety will not be affected.	No. Public health and safety will not be affected.
3.) Will the proposed alternative significantly affect any unique characteristics of the geographic area, such as proximity to historic or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?	No. The experimental site is not located in any of these unique areas.	No. The experimental site is not located in any of these unique areas.
4.) Is the alternative likely to be highly controversial?	No. The alternative is site-specific, small, and experimental.	No. The alternative maintains the status quo for mussel relocation methods.
5.) Are there any significant possible effects on the human environment that are highly uncertain or involve unique or unknown risks?	No. The alternative is site-specific, small, and does not pose a significant effect on the human environment.	No, the alternative will maintain the current status quo.
6.) Will the alternative establish a precedent for future actions with significant effects or does it represent a decision in principle about a future consideration?	No. The alternative is site-specific, small, and experimental. It will not affect existing mussel removal methods.	No. The alternative maintains the status quo for mussel relocation methods.
7.) Is the alternative related to other actions with individually insignificant but cumulatively significant impacts?	No. The alternative will not affect the current process for considering mussel relocation in any project.	No. The alternative will not affect the current process for considering mussel relocation in any project.
8.) Will the alternative have a significant adverse effect on districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss of significant scientific, cultural, or historical resources?	No. The alternative will not have a significant adverse effect on these resources.	No. The alternative will not have a significant adverse effect on these resources.
9.) Will the alternative adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973?	No. According to the USFWS Biological Opinion, the alternative will not affect species or habitat determined to be critical, and is not likely to jeopardize the continued existence of species listed in the Biological Opinion.	No. The alternative will maintain the current status quo.
10.) Does the alternative risk a violation of Federal, state, or local law, or requirements imposed for the protection or the environment?	No. The alternative does not risk any violations.	No. The alternative does not risk any violations.

* “Significantly” defined under the National Environmental Policy Act (NEPA),
Title: 40 – Protection of the Environment, Part 1508.27

3.0 AFFECTED ENVIRONMENT

3.1 Water Quality

The Tennessee 2002 305(b) reports that the water quality in the proposed experimental river reach is assessed as good and supports all its designated uses. These designated uses are: Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, Recreation, Irrigation, Livestock Watering & Wildlife, and Navigation. Four dischargers are located within the 11-mile river reach upstream of the proposed experimental site.

3.2 Aquatic Resources

The Pickwick Dam tailwater is known for its fishery and commercial mussel harvests. In 2001, TVA rated the ecological health of Kentucky Reservoir as good. The fish community was rated as good based on the large number and diversity of healthy fish collected. Monitoring results rated the benthic community as good based on the diversity of organisms collected.

The river reach below Pickwick Lock and Dam has historically supported major freshwater mussel populations. A Mussel Sanctuary was established by TWRA below Pickwick Lock and Dam at TRM 206.7 downstream to TRM 201.9. The river reach below the sanctuary is permitted for commercial musseling.

River sand and gravel is also a natural resource. Commercial sand and gravel extraction is permitted within designated river miles on the Tennessee River including the area in which the experiment will be conducted.

3.3 Terrestrial Resources

The landuse surrounding TRM 195.0-194.0 is dominated by agriculture. Row crops flank both sides of the river. There are small bands of riparian woods adjacent the river on top of the bank. Wildlife would be expected to include white tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), rabbits (*Oryctolagus cuniculus*), opossum (*Didelphis virginiana*), squirrels (*Sciuridae*), reptiles, and waterfowl.

3.4 Endangered and Threatened Species

The Tennessee Department of Environment and Conservation, Natural Heritage Section, provided a list of mussel species that might be found in the experimental site. During a 2002 TWRA field reconnaissance, one pink mucket (*Lampsilis abrupta*) was collected within and relocated outside of the experimental site. This find initiated a Corps request for formal consultation under Section 7 of the Endangered Species Act that concluded with a Biological Opinion and Incidental Take for the initial 2002 experiment. During the initial experiment on September 17, 2002, four pink muckets were collected and handed over to TWRA. The listed mussels did not appear to have any obvious physical damage. No mussel was gaping or slow to close when disturbed, and there was no putrefied odor (Salazar and Salazar, 2000). TWRA found one fanshell (*Cyprogenia stegaria*) in the experimental site after the initial experiment. To date, no mussel damage or poor condition has been reported for these listed species.

3.5 Cultural Resources and Historic Properties

In the opinion of the Tennessee SHPO, no National Register of Historic Places, listed or eligible properties would be affected by this undertaking (June, 13, 2002).

3.6 Navigation and Safety

The experimental site is located outside the navigation channel. Traffic will be notified to proceed with caution.

3.7 Contamination

The TVA ecological health rating in 2000 noted that sediment within the Kentucky Reservoir was rated as good. A good rating means that the reservoir bottom is free of pesticides and that PCBs and metal concentrations are within expected background levels. Currently there are no swimming or fish consumption advisories within the project area (Tennessee 200 305(b) Report). Based on, EPA 404 guidance - Part 203.60 General evaluation of dredged or fill material - if the material is sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge is not a carrier of contaminants, then the required determinations pertaining to the presence and effects of contaminants can be made without testing. Dredged or fill material is most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material.

3.8 Air Quality

The proposed experimental site is within an attainment area and is not considered to be regionally significant under the Clean Air Act.

3.9 Floodplains

The proposed experiment occurs within the Tennessee River and associated floodplain. Water levels are generally controlled by the operation of Pickwick Dam. Both the backwater effects from Kentucky Reservoir and river flows can affect floodwater heights. For Kentucky Reservoir, the winter pool elevation is 354.0 and the summer pool elevation is 359.0. The 100-year and TVA Flood Risk Profile (FRP) elevations at TRM 195.0 would be 398.4 and 400.7 respectively. At this location, the FRP is equal to the 500-year flood elevation

3.10 Environmental Justice and Socioeconomics

In 2000, minority populations in Hardin County comprised nearly 5% of the total population. This representation is below 50%, which identifies the significant presence of a minority population. The 1999 poverty level in Hardin County was about 18.8%. This level was above the state average of 13.5%, but below the Census Bureau's poverty threshold of 20%, which is used to identify low-income populations.

Based on the 2000 U.S. Census, Hardin County contained approximately 25,600 residents. This represents about 0.4 % Tennessee's total population (5,790,000). The 2000 median income was \$24,500, which was below the State median (\$30,500).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Water Quality

Water quality effects resulting from implementing the experiment would include temporary, short-term, and highly localized periods of turbidity and suspended solids. Material at both the test dredge and disposal sites consist of cobble, gravel and sand. Given the large particle size, suspended solids would settle out quickly. This effect would not impair designated uses nor release any contaminated sediment into the water column. Compared to the amount of turbidity and suspended solids observed during flood conditions, the effects resulting from implementing the experiment would be negligible.

Under the no action alternative, site-specific water quality would remain unchanged.

4.2 Aquatic Resources

Implementing the experiment would directly impact benthic organisms and their habitat. During excavation, animals would be dislodged, disrupted, and relocated. Some animals would probably be crushed. Material disposed in the placement site would cover resident animals. A temporary reduction in the local density and distribution of the benthic organisms would occur, and the benthic habitat would be altered. This impact is unavoidable. The proposed experiment would dredge less than 100 cubic yards of material and potentially affect a total surface area of ½ acre. In perspective, this amount of disturbance in the Tennessee River is not likely to affect the continued existence of these benthic organisms since similar populations exist within the Tennessee River.

Fish are mobile and would likely avoid the experimental site during implementation. They would be expected to return on completion of the experiment. Fish and mussel spawning activities would be avoided since the experiment has been rescheduled for the fall.

River sand and gravel are also natural resources that are extracted for commercial uses. The Corps Planning Branch coordinated with the Corps Regulatory Office and commercial sand and gravel permit holders. These companies voluntarily agreed to avoid TRM 194.0-195.0 for up to four years. This cooperative action would prevent extraction disturbance in the experimental site.

Under the No Action alternative, no aquatic organisms or their habitat would be disturbed. Commercial extraction would not be affected.

4.3 Terrestrial Resources

The proposed experiment would occur within the river. Disturbances to terrestrial wildlife would be minimal and temporary. These animals are mobile and could seek food and shelter elsewhere. On completion of the experiment, wildlife would be expected to return to pre-experiment conditions.

Under the No Action alternative, no terrestrial organisms would be disturbed.

4.4 Endangered or Threatened Species

The find of four pink mucklets (*Lampsilis abrupta*) and one fanshell (*Cyprogenia stegaria*)

during implementation and after the initial experiment constituted new information. In accordance with Section 7 of the Endangered Species Act, the Corps initiated formal consultation for the second experiment on August 8, 2003. On November 13, 2003, the USFWS issued a Biological Opinion concluding that the second experiment was not likely to jeopardize the continued existence of the listed mussel species, nor likely to destroy or adversely modify designated critical habitat. The Incidental Take is one individual per the following listed species: pink mucket (*Lampsilis abrupta*), white wartyback (*Plethobasus cicatricosus*), rough pigtoe (*Pleurobema plenum*), ring pink (*Obovaria retusa*), and cracking pearlymussel (*Hemistena lata*).

Under the No Action alternative, no potential endangered species would be disturbed.

4.5 Cultural Resources and Historic Properties

The initial experiment was coordinated under Section 106 of the National Historic Preservation Act. In a letter dated June 13, 2002, the Tennessee SHPO concluded that there were no National Register of Historic Places listed or eligible properties affected within the experimental site.

Under the No Action alternative, cultural resources and historic properties would not be affected.

4.6 Navigation and Safety

The proposed experiment is not expected to affect navigation or safety. The experimental site is located outside the existing navigation channel. Flagging would be used when divers perform work in accordance with the Corps safety manual, EM 385-1-1.

Under the No Action alternative, navigation and safety would not be affected.

4.7 Contamination

Contamination is not expected to result from the proposed experiment. The river substrate consists of cobble, gravel, sand, and some fines. Due to the type and particle size of the material, contaminants are not expected to adhere to the particles.

The no action alternative would have no affect on contamination.

4.8 Air Quality

The proposed experimental site is within an attainment area under the Clean Air Act. Short-term, localized impacts resulting from equipment exhaust emissions would be negligible and is not expected to affect the general air quality within Hardin County.

The No Action alternative would have not affect air quality.

4.9 Floodplains

All materials would be deposited in the river. No material would be deposited on shore. Therefore, neither alternative would impact the floodplain or redistribute sediment in such a way as to impact flood levels.

4.10 Environmental Justice and Socioeconomics

The proposed action would not present a disproportionate adverse impact on any segment of the population, including minority or low-income people or communities. The aquatic resources are accessible to all citizens regardless of race, color or creed. Therefore, neither alternative would impact the either environmental justice or socioeconomics.

4.11 Cumulative Effects

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the (proposed) action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7)”. Council for Environmental Quality (CEQ) guidance identifies an 11-step process for evaluating cumulative effects.

The assessment can be defined by “what resource goals is the proposed action going to affect”. Effects can result from either direct-project related, indirect-project related, and independent indirect causes. Based on the public and agency scoping and review performed for the previous NEPA documents conducted for this experiment, the significant resources identified are the freshwater mussels.

The geographic area covered by this cumulative effects evaluation is the Tennessee River and its tributaries. The temporal boundaries range from the early 1900s to 2050.

Human actions within the last 75 years have exerted significant impacts on the aquatic ecosystem. Populations demanded hydropower, improved navigation, water supply, flood control, recreation, and flow augmentation for wastewater assimilation. To support these demands, the river was altered from a free-flowing river system to a slower and deeper reservoir system with the construction of dams. Dams have been built for several millennia. However, dams built within the last 75 years were built on a large enough scale to alter the biotic and abiotic characteristics of the impounded river sections resulting in a distinct type of ecosystem (Watters, 1999).

Over this time period, endemic freshwater mussels were arguably hit hardest by the cumulative impact resulting from the physical and water quality changes in the impounded river system. Species that could not adapt to the new flow regime, water quality, and fine-grained habitat were threatened or extirpated altogether. Several species have become extinct. Historically, 297 species of mussels existed. Of the remaining 276 species nearly one-fifth are listed as endangered or threatened (Cope and Waller, 1995). Consequently, any activity affecting mussels or their habitat is a concern.

Mussels may be characterized as tending to stay in the same general location once established in a suitable habitat (Nedeau et.al., 2000). Because of this limited lifestyle, it is best for the mussels to avoid them. Where mussels cannot be avoided, impacts can be minimized. Mussels can be hand collected and relocated by divers. The need for relocation may be caused by instream construction activities, bridge construction, dredging and channel maintenance or other instream disturbances. Sometimes mussels are relocated to supplement other populations or re-colonize

areas where mussels previously existed (Jenkinson and Todd, 1997; Federal Register, 2001). Mussel relocation has been used as a conservation and management tool for several decades, however, evaluation of 37 relocations revealed an average survival rate of ~ 51% and average recovery rate of 43% (Cope et. al, 2002). Cope and Waller (1995) reviewed 37 relocations and found that the number of individual relocated mussels ranged from 44 – 18,300. However, it is possible to remove larger numbers of mussels. Sickel and Burnett (2001) were able to collect, identify, count, and relocate 53,803 mussels over a 3-week period. These individuals were concentrated in approximately 1 acre, and the relocation site was less than 0.25 miles away.

The overall effect of mussel relocation appears to be beneficial. Mussels that probably would have been destroyed by instream disturbances were rescued. Redistributing populations reduced the risk of endangering a species in the event of a localized spill or die-offs. Relocated mussels can augment existing populations or re-establish populations within historic ranges (Cope and Waller, 1995; Nedeau et. al., 2002; Federal Register, 2001).

Reasonably foreseeable future actions that will affect this resource include continued water quality concerns, maintaining segmentation of the waterway by dams, maintenance dredging, sand and gravel extraction, growing development of the watershed and associated erosion and sedimentation problems, municipal and industrial point source discharges, and increased use of the river for transportation and recreation. It is unlikely that any of these stressors will change. Some of the listed stressors can be expected to increase over time. It is therefore also reasonable to assume that mussel relocations will continue as a means to minimize impact to the resource. Relocation efforts might consider the experimental mussel relocation method as an alternative to diver removal and relocation when realistic and practical limitations such as time, experience, labor, funding, area impact size, and enormous mussels numbers affect the collection effort.

As noted above, the maximum affected area encompassed by this experiment is about ½ acre. Compared with the area of equivalent habitat within the Tennessee River, the effect of this experiment would be insignificant. All possible mitigation measures identified by the resource agencies have been incorporated into the experiment's protocols (see Appendix A), and two formal monitoring events have been planned to evaluate the success or failure of the experiment.

5.0 ENVIRONMENTAL COMMITMENTS

5.1 Environmental Safeguards

Actions that would be taken to minimize impact to the mussel population during implementation of the proposed experiment include the following:

1. The proposed experiment has been coordinated with appropriate state and federal agencies.
2. The proposed experiment would implement redesigned protocols to ensure collection of reliable data and to capture data gaps.
3. QA/QC has been incorporated into the redesigned protocols.
4. The action areas are small, affecting a total of ½ acre to minimize impact.
5. The proposed activities would occur in the fall to avoid fish and mussel spawning activities.
6. The proposed experiment would occur when the water temperature is 60°F or higher.

7. The Corps would employ divers to conduct preliminary 0.25 square meter quadrat sampling and timed searches within the selected dredge and disposal sites prior to any action to assess the existing resource.
8. Listed species found within the footprint of the proposed test sites would be handed over to TWRA for care.
9. Dredged material would be placed in a single layer in the scow.
10. Dredged material would be maintained in a wet condition.
11. Dredged material would be taken to an area with appropriate depth and substrate composition.
12. The dredge site would be evaluated for remaining mussels.
13. Deposition depth would be checked to evaluate burial of resident mussels remaining in the placement site.
14. Mussel handling time would be kept to a minimum.

Implementing these safeguards will minimize impact to the mussel resource. In addition, two monitoring events have been planned to evaluate survival. One monitoring event would occur within 0-3 months after the experiment, and a second monitoring event would occur 3-14 months after the experiment. The Corps would request natural resource agencies to suggest time windows for these two monitoring events.

6.0 CONCLUSION

Current mussel relocation projects use divers to hand collect and relocate mussels out of an area of impact. Removal efficiency, timeliness, diver and mussel safety, and funding are factors that affect the success of any relocation effort. These factors become a concern when relocation involves large numbers of mussels. The concept of moving large mussel beds using a remote method such as the experimental method should be considered. A scientific assessment of the experiment would help determine if this method could be considered as a viable mussel relocation method that might be used as a tool in mussel conservation and management efforts. Based on the analysis of this EA, Alternative 1 – Proposed Action – implement the experiment, is recommended.

7.0 PUBLIC INVOLVEMENT

7.1 Scoping and Public Notice Notification

Public Notice, No. 02-03, was released on July 31, 2003 to the public, governmental agencies and officials, Indian Tribes, and other interested parties. This notice served as scoping to solicit comments that should be considered and evaluated with respect to potential environmental impacts of this proposed experiment. Comments regarding environmental issues would be addressed in the course of the NEPA process. Appendix D contains the Public Notice and responses to the second experiment. Comments were given full consideration resulting in a substantial revision of this EA.

7.2 Consideration of Public Comments

Comments received have been incorporated into the 2004 EA.

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9.0 LIST OF PREPARES

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Appendix A

Proposed Redesigned Experimental Protocols

PROPOSED REDESIGNED EXPERIMENTAL PROTOCOLS **An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging**

Introduction: The purpose of this document is to describe in a standard operating procedure for this experimental method in relocating mussels using dredging equipment. The performance of scientific evaluations and the collection of quality data would be necessary in order to evaluate mussel mortality associated with action of the clamshell bucket dredge. The Tennessee Wildlife Resources Agency (TWRA) would be performing quality control checks. The Malacologist In Charge (MIC) would be a scientist from a government organization. General conditions for this experiment are as follows:

- A. Sorting process: Quadrat and clamshell bucket samples would be washed through a series of stacked screens sized 3, 1½, ½, and ¼-inch openings.
- B. All mussels encountered would be:

• Identified.	• Measured by screen grouping. If time allows, some mussels would be measured with calipers.
• Counted.	• Checked, and general condition noted (includes abnormalities, cracks, chips, broken shells).
• Maintained in good health.	• Kept together per sample in tagged bags until returned to the river.
	• Handed over to the TWRA for care and relocation outside the test sites unless used for mark and recapture.
- C. All listed species would be removed from the samples and handled separately. State and Federally listed species would be individually identified, counted, measured in length, aged (height and wet weight optional), and checked for general and reproductive (sexed) condition. Listed species would be handed over to the Tennessee Wildlife Resources Agency once data has been collected.
- D. Quality Assurance/Quality Control (QA/QC) – A subset of the activities (as noted) would be redone to check for accuracy. TWRA would be filming underwater conditions. Filming would be a separate and independent action occurring when equipment and contract divers are out of the water.
- E. The MIC (from a participating agency) would determine completion of an activity, and help develop a rating system to indicate level of injury, damage, or impact. The MIC would hand over all live animals not used for mark and recapture, to TWRA for care and relocation outside the test footprints.
- F. TIME. The length of the experiment would be a total of 3 days, from start to finish, scheduled for the week of September 8, 2003.
- G. As time allows, the next task can be initiated and completed regardless of Phase.
- H. Contract divers must meet U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), Section 30 – Contract Diving Operations. All standard safety protocols related to field and barge work would be followed. (Safe diving advises river flows between 20-30 thousand cubic feet per second.)
- I. CONTINGENCY PLAN: In the event something happens that would affect the Phases or Tasks of the experiment (weather, equipment failure, injury, illness), a meeting of the agencies represented on site, would determine the course of action. They would document reasons for deviations and modifications.
- J. A pre-meeting would take places to discuss objectives and purpose of the study, as well as logistics, would be held with key personnel prior to fieldwork
- K. A safety meeting with divers would be held each day.
- L. At the end of each workday, key personnel would meet to review the day's activities and plans for the remainder of the study.
- M. A follow up meeting, to include all key personnel, would be held at an appropriate time after the field study has been completed and data have been analyzed.

PHASE I - Task I – Documenting Site locations and Existing Conditions		
	CORPS	Resources Agency QA/QC
1) Site selection	The purpose of this task is to delineate the dredge removal and placement sites. Coordinates would be recorded using a global positioning device (GPS) in a format useful to all agencies so that sites can be relocated accurately in subsequent years on printed maps.	TWRA would select test dredge and placement sites. Optimally, a placement site with few mussels. The experiment would take place within the same general area used for the September 2002 study, possibly moving either immediately upstream or downstream of the previous experimental locations.
2) GPS Coordinates	The Corps would log GPS coordinates for all site locations in Degree, Minute, Second, using Datum 1983. Points would be identified on a digital USGS Topographical Map. . CONTRACT DIVERS: Divers would verify test dredge and disposal locations with the MIC. Divers would note ease of relocating the test sites above and below the water.	
a) Survey Area	The Corps Survey boat would conduct a bathymetric survey to map the existing bottom at the dredge and placement areas.	
b) Boundary Marking	The Corps would mark dredge and placement site boundaries, and scow disposals lines with appropriate temporary marking (example: PVC, chains, floats, etc.) for easy relocation above and below water CONTRACT DIVERS: Divers would secure up to 3 chains/cables/ropes (provided), or other appropriate markings across the original substrate in the test disposal area, running horizontally with the riverbank.	
c) QA/QC	A subset of the GPS coordinates would be rechecked with a second GPS unit. QA/QC would be coordinated with a participating agency.	After the test dredge and placement sites have been marked, TWRA would videotape the sites underwater to document existing conditions.

PHASE I - Task II – Preliminary Evaluation – Quadrat Sampling in Removal and Placement Sites.		
	CORPS	Resource Agency QA/QC
Preliminary 0.25 square meter Quadrats sampling – Estimating mussel density		
1) Quadrats		
a) Collection	The purpose of this task is to characterize density, evidence of recent recruitment, and relative species abundance, using quantitative methods, of mussels in the dredge and placement sites. CONTRACT DIVERS: Divers would collect 20 (40 total) substratum (0.25 square meter) quadrats at each of the two sites (dredge and placement sites). Material would be placed in a 5-gallon bucket, hoisted to the surface, and processed at an appropriate site.	

b) Sorting Process	<p>CONTRACT DIVERS: Each quadrat sample would be washed (using water pumps) through a series of stacked graded screens (See Note A). All mussels would be removed and maintain in good condition. All mussels would be given to the MIC for further processing.</p> <p>The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) Marking	The MIC would identify a subset of non-listed mussels for a mark and recapture experiment using battery operated dremel tools or similar device.	
d) QA/QC	CONTRACT DIVERS: A portion of the sieved material would be retained and re-sieved to indicate accuracy of that process and mussel picking efficiency.	.
e) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE I - Task III – Preliminary Evaluation – Timed Searches in Removal and Placement Sites		
CORPS		
1) Timed Searches		
a) Time	<p>The purpose of this task is to use qualitative collection methods to obtain information on relative species abundance and presence of uncommon (listed) mussel species.</p> <p>CONTRACT DIVERS: Four – 15 to 30 minute searches would be conducted in the dredge and placement sites. Divers would attempt to collect all live mussels without size bias, as it is difficult to discern endangered species underwater. Divers would hand mussels over to the MIC. Report results as catch per unit of effort (CPUE). This would allow before and after comparisons. All mussels would be hand over to the MIC.</p>	
b) QA/QC	MIC would compare results from different divers working in the same area to determine search efficiency.	
c) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C.)	TWRA would verify identifications, counts, and general condition of the mussels.
d) Marking	MIC would retain a subset of non-listed mussels for marking as in Phase II, Task IV.	
e) Completion	The MIC would consult with TWRA to determine task completion. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE II - Task IV – Clamshell Bucket Scoop Evaluation. Dredge bucket impact (inside)		
Clamshell Bucket Scoops – Full and Partial scoops		
CORPS		Resources Agency QA/QC
1) Seeding	<p>The purpose of this task is to examine recently dredged material to assess the number of mussels that are either damaged or killed. Assessment would be made based on a developed rating system. Results would be expressed as the number damaged or killed, compared with the total collected from each scoop.</p> <p>CONTRACT DIVERS: Marked non-listed mussels would be distributed within the test dredge area in a pre-determined pattern and density for mark and recapture.</p>	
2) Bucket Scoop		
a) Collection	<p>1-3 partial scoops and 1-3 full scoops of bottom material would be collected with a clamshell dredge bucket in the removal area. Each bucket scoop would be placed on a flat barge one at a time. This material would be maintained in a wet condition.</p>	TWRA would film the impact of scoop depressions noting partial or full scoop depression.
b) Sorting Process	<p>Before processing, and as the work proceeds, the dredged material would be carefully inspected and all living and recently damaged mussels would be removed by hand as they are observed. Each dredge bucket scoop would be considered a single sample. Sediments from the scoop would be continuously run through the stations.</p> <p>CONTRACT DIVERS: Dredged material would be carefully shoveled from the deck and placed on the top of a nested screen series and processed as in Phase I Task II above. The material would be hosed with river water to wash the sediment through the screens. Stacked screens would be set within a containment area to capture fine sediment washed through the screens. Full screens with washed sediment would be separated by screen size and carried to respective sorting tables. Mussels would be picked from screen trays. Mussels would be maintained in good health. Mussels would be carried to the MIC sorting table for further processing.</p> <p>MIC would identify, count, size by screen groups (measure individually as time allows), note condition and marking and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	<p>CONTRACT DIVERS: A portion of the sieved material would be examined for mussel picking efficiency and washed fines would be sub-sampled using a tray with 1/8 inch mesh to determine small mussel recovery.</p>	
d) Completion	<p>The MIC would consult with TWRA to determine task completion and when to discard all sieved material.</p>	TWRA would take possession of all mussels not used in the experiment and relocate them outside the test footprints.

PHASE II - Task V – Bottom Evaluation – Quadrat Sampling in Dredged Site. Dredge bucket impact (outside)		Resources Agency QA/QC
CORPS		
1) Post-dredged 0.25 meter Quadrats and Timed Searches		
a) Collection	<p>The purpose of this task is to use quantitative methods to assess the number of mussels that remain or are injured on the river bottom below the bucket scoop depth.</p> <p>CONTRACT DIVERS: Divers would collect up to 8 – 0.25 quadrats out each test dredge scoop depression on the river bottom. Divers would describe all underwater conditions while samples are taken. Note partial or full scoop depression. Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing.</p> <p>Divers would conduct timed searches over the entire scoop depression after quadrats have been taken. Record as CPUE for comparisons.</p>	
b) Sorting Process	<p>CONTRACT DIVERS: Each quadrat would be washed (using water pumps) through a series of stacked graded screens (See Note A.). All mussels would be removed and maintain in good condition and given to the MIC.</p> <p>The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	CONTRACT DIVERS: A portion of the washed fines would be sub-sampled to determine small mussel recovery.	
d) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material.	TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.
PHASE II - Task VI – Clamshell Dredge Removal Efficiency		Resources Agency QA/QC
CORPS		
1) Clamshell Dredge Scoop Samples		
a) Dredging	<p>The purpose of this task is to study effects of full and partial bucket dredging and placement in the river.</p> <p>The clamshell dredge bucket would be operated according to normal procedures. Separate areas would be used within the test dredge footprint for full and partial bucket removals. Light scoops would be placed in a single layer in one dump scow containing water. The dump scow would be moved to the placement site and the material deposited. The scow would be returned to the dredge site and Full scoops would be placed in a single layer within a dump scow containing water. The dump scow would be moved to the placement site and the material deposited.</p>	

b) Survey Area	On completion of the dredging, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the dredge area.	On completion of the dredging, TWRA would film the new bottom topography.
c) Bucket Evaluation	CONTRACT DIVERS: Divers would inspect the partial bucket and full bucket dredge areas. Four 15 to 30 minute timed searches would be conducted to evaluate dredge bucket removal efficiency and to collect any remaining and damaged mussels. Record as CPUE for comparisons.	
d) Completion	This activity would be complete when the dump scow disposals are complete and the scow is out of the area.	

PHASE III – Task VII – Dump Scow Placements - Post-Placement Evaluation (Within 48 hours) Timed Searches		
	CORPS	Resources Agency QA/QC
1) Post Placement – Timed Searches		
a) Placement	Each time, the scow would align perpendicular to the bank. It would slowly open the hull and back up to disperse the dredged material in a thin layer.	
b) Survey Area	On completion of the disposals, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the disposal site.	On completion of the disposals, TWRA would film the new bottom topography.
c) Timed Searches	<p>The purpose of this task is to use qualitative methods to collect mussels from dredged material piles in the placement areas so investigators can examine mussel damage <i>in situ</i>.</p> <p>CONTRACT DIVERS: Divers would conduct four 15 to 30 minute searches over all the discernable disposed material. All mussels and freshly cracked, chipped or broken shells would be brought to the surface, as it is difficult to discern endangered species underwater. Record as CPUE for comparisons. All material would be given to the MIC.</p>	
d) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)	TWRA would verify identifications, counts, and general condition of the mussels.
e) Completion	The MIC would consult with TWRA to determine task completion.	TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.

PHASE III - Task VIII – Post-Placement Evaluation (Within 48 hours) Quadrat Sampling		Resources Agency QA/QC
CORPS		
1) Post-Placement 0.25 meter Quadrats		
a) Collection	<p>The purpose of this task is to use quantitative methods to obtain an estimate of density and to evaluate the new distribution patterns and condition of dredged mussels transported by the scows.</p> <p>CONTRACT DIVERS: Divers would collect twenty 0.25 square meter quadrats from the disposed material in the placement footprint. Using the chain/cable/rope, note depth of disposed material over the original substrate when collecting the quadrats. Note location and mussel position in the substrate especially for of any marked mussels collected.</p>	
b) Sorting Process	<p>CONTRACT DIVERS: Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing through a series of stacked screens (See Note A). Pick mussels out of screens and maintain in good condition. Hand over all mussels to the MIC.</p> <p>MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	CONTRACT DIVERS: A portion of the washed fines would be sub-sampled to determine small mussel recovery. The fines would be washed through a tray with 1/8 inch mesh.	
d) Completion	The MIC would determine when this task is complete.	TWRA would take possession of all mussels for care and relocation outside the test footprints.

PHASE III -Task IX – Documentation.		Resources Agency QA_QC
CORPS		
1) Data Reports	The MIC would generate the reports. All field data sheets would be put in electronic format. A progress report would be submitted to the participating agencies within 2 months of the field surveys. A final report summarizing the results of the whole project would be submitted to the participating agencies within 4 months. Within 30 days of report completion, all participating agencies would meet and discuss the project and major findings.	

<p>2) Success Criteria</p>	<ul style="list-style-type: none"> • Time – survival rate within 48 hours and 12-14 months later. • ~ % Survival in scoops examined in detail • ~ % Removal efficiency – Comparison of pre post survey results • ~ % Mortality at the removal site • ~ % Survival at relocation site <p>The overall impact of this method is based on impacts to the mussel fauna. Negative impacts include mortality and significant shell damage. It may be possible that impact estimates may be species and size specific. Impacts would be assessed 1.) Dredge material within the bucket; 2.) Dredged material outside the bucket; 3.) And, dredged material placement. Some mortality and shell damage information may be obtained from the marked and replaced mussels. Some general information on efficiency of dredge bucket removal can be obtained by diver observations and sampling in the removal area after dredging has taken place.</p> <p>The impacts of the dredge on mussels in this method are obviously related to the percentage of mussels killed or damaged by this method. To put this into perspective, a comparison can be made with the percentage of mussels that are likely to be obtained by hand (collection efficiency) using divers.</p>
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Appendix B

Section 404(b)(1) Evaluation

**PRELIMINARY
SECTION 404(b)(1) EVALUATION**

**EXPERIMENTAL MUSSEL RELOCATION
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
JUNE 2004**

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**PRELIMINARY
SECTION 404(b)(1) EVALUATION**

**EXPERIMENTAL MUSSEL RELOCATION
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
JUNE 2004**

I. Project Description

The proposed action is to implement an experimental mussel relocation method using redesigned protocols.

A. Location

The 2004 experiment would be conducted just upstream of the city of Crump in Hardin County, Tennessee (Figure 1.). The experimental site (Figure 2.) is located between approximate Tennessee River Miles 194.0 (Latitude 35° 12' 23", North; Longitude 88° 18' 42", West) and Tennessee River Mile 195.0, (Latitude 35° 11' 32", North; Longitude 88° 18' 33", West) on the left descending bank, in Kentucky Reservoir. The experimental site can be located on a U.S. Geological Survey 7.5 Minute Series Quadrangle map labeled 13 NE – Pittsburg Landing.

B. General Description

A clamshell dredge would remove the top layer of river substrate. Two dredging treatments would be used; full dredge buckets and partial dredge buckets. The material would be placed into a dump scow one layer deep and transported for placement in open-water in a selected disposal footprint. The split hull would be carefully opened to disperse the substrate in a thin layer over the river bottom. The clamshell dredge bucket is designed to hold approximately 3 cubic yards (~600 gallons) of material. Test buckets (1-3 full buckets; 1-3 partial buckets) would be placed on a flat barge. Each bucket of material would be processed through a stack of graded screens (3, 1½, ½, ¼ inch mesh). Mussels would be picked from the screens and identified, counted, and measured by group size. Mussels would be inspected for markings or damage. Divers would inspect the bucket depressions on the river bottom for remaining mussels. Non-listed mussels are the targeted test organisms in this experiment.

C. Authority and Purpose

The Rivers and Harbors Act of July 3, 1930 (46 Stat. 927) authorized permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth of the river to Knoxville, Tennessee. The Tennessee Valley Authority Act of 1933 (16 U.S.C. §§ 831-831ee) authorized TVA to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the TVA Act, the Corps of Engineers, in cooperation with TVA, has maintained navigation channels on TVA projects by performing necessary maintenance dredging operations. This division of responsibility is outlined in the October 26, 1962 *Memorandum of Agreement between the Department of the Army and Tennessee Valley Authority for Construction, Operation, and Maintenance of Navigation Facilities on the Tennessee River and its Tributaries*. This MOA assigns

responsibility for maintenance of the main navigation channel to the Department of the Army, and provides that TVA will be responsible for new facilities and recreational navigation channels. Maintenance of an open channel is considered part of TVA's statutory mission. TVA is a cooperating agency in the preparation of this Environmental Assessment (EA).

D. General Description of Dredged Material

1. General Characteristics of Material

The material consists of sand and gravel.

2. Quantity of material

Approximately 100 cubic yards of material would be excavated.

3. Source of Material

The dredge material is the result of natural river sand and gravel deposition.

E. Description Of Proposed Discharge Site

1. Location

The test placement footprint is located within an experimental site (Tennessee River Miles 194.0-195.0) currently permitted for commercial sand and gravel extraction.

2. Size

Approximately ¼ acre of surface area would be covered with a thin layer of dredge material.

3. Type of Site

The discharge site is located in open-water.

4. Types of Habitat

The river substrate contains sand and gravel that provides fish and mussel habitat.

5. Timing and Duration of Discharge

The proposed time frame is between September and October. Discharging two split hull scows would take a few hours.

F. Description Of Disposal Method

A clamshell dredge would be used to place buckets of material, one layer deep, inside a scow. The hydraulically operated split-hull scow would be used to disperse the dredge material on the river bottom in a thin layer.

II. Factual Determinations

A. Physical Substrate Determinations

1. Substrate Elevations and Slope

The substrate elevation averages around 330 feet in mean sea level with some riverward slope.

2. Sediment Type

The sediment consists of gravel and sand.

3. Dredged/Fill Material Movement

Due to the large particle size of the dredge material, and shallow disposal depth, dredge material is not expected to move.

4. Physical Effects on Benthos

The immediate effect would be physical. Benthic organisms would be dislodged, relocated, and covered. Some would probably be injured and crushed. This effect is unavoidable. This affect would be limited to a ¼ acre surface area. The original community structure would be altered. However, the composition of the substrate (sand and gravel) is not expected to change and colonization by an equivalent benthic community is expected.

5. Other Effects

Fish would be disturbed and would temporarily move from the area, but this effect is short term and limited in area.

6. Actions Taken to Minimize Impacts

Efforts would be made to avoid fish and mussel spawning activities. Work has been rescheduled for the fall during low flow conditions to minimize water quality impacts resulting from turbidity. Water temperature is expected to be a minimum of 60^o F. At this temperature, mussels are considered active enough to reposition themselves when disturbed. Divers would survey the footprint prior to any mechanical activity. Mussels would be collected during timed searches and quadrat sampling. Mussels not used in the experiment would be removed from the test footprints.

B. Water Circulation, Fluctuation, And Salinity Determinations

1. Water

Kentucky Reservoir maintains a regulated pool. Water fluctuations are scheduled as part of a pool operations plan. The reservoir has been generally well mixed lacking thermal or dissolved oxygen stratification in the experimental site, which is riverine in character.

a. Salinity

Not applicable. The proposed action occurs in a freshwater system.

b. Water Chemistry

Water chemistry would not be affected by dredge material mixing in the water column. The dredge material consists of inert sand and gravel.

c. Clarity

Due to the relatively large particle size of the dredged material, any decrease in water

clarity is expected to be minor, localized, and short-term due to rapid settling of the substrate.

d. Color

The dredged material would not affect the true color of the water. The material is composed of inert and insoluble sand and gravel. Localized effects on apparent color would be seen; however, this effect would be temporary and localized given the large particle size of the material.

e. Odor

The proposed activities would not have any effect on odor. The substrate contains very little organic matter.

f. Taste

The proposed action would not have any effect on taste. The dredged material consists of insoluble material.

g. Dissolved Gas Levels

The proposed activities would not affect the composition or nature of dissolved gases in the water column. No biological or chemical oxidation demand would be expected to occur since the dredge substrate consists of inert material.

h. Nutrients

The proposed activities would have no effect on nutrient concentrations. The dredged material consists of inert material.

i. Eutrophication

The proposed action would have no effect on eutrophication. This process does not occur in a riverine river segment.

j. Others as Appropriate

Parameters of physical and chemical quality (Temperature, Specific Conductance, Dissolved Oxygen, hardness, and pH) would not be affected by the work. The dredge material consists of inert sand and gravel.

2. Current Patterns and Circulation

The proposed activities would not affect existing current and circulation patterns. The amount of material proposed for disposal would be negligible. Spreading the dredge material in a thin layer would prevent any obstruction to circulation.

a. Current Patterns and Flow

The proposed action would not change existing current patterns or flow in the river. The water depth and low profile of the dredge material would not affect current patterns.

b. Velocity

Water velocity would not be affected by the proposed experiment. The flow of the Tennessee River is large and regulated.

c. Stratification

The proposed activity would be located in a segment of the Tennessee River considered riverine in character precluding stratification.

d. Hydrologic Regime

The proposed activities would not affect the normal fluctuations in the hydrologic regime of the Tennessee River.

3. Normal Water Level Fluctuations

The proposed action would not affect the normal water level fluctuations in the Tennessee River. Water level is influenced by pool operations and releases by both Pickwick and Kentucky Locks and Dams.

4. Salinity Gradients

Not applicable. The proposed action would occur in a freshwater system.

5. Actions That Will Be Taken to Minimize Impacts

Based on visual inspections, all efforts would be made to ensure compliance with State water quality rules and permits. The work would occur during daylight hours and anticipated low flow fall conditions to minimize potential water quality impacts.

C. Suspended Particulates/Turbidity Determinations

1. Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

Re-suspended material from dump scow disposal would be small. Elevated levels of suspended particles or turbidity would be localized and short-term. The dredge material consists of gravel and sand. Given the large particle size, the material would be expected to settle out of the water column quickly. On completion of the activities, local turbidity would be expected to return to background levels. In perspective, disposal induced turbidity and suspended solids are an insignificant fraction of levels that occur during ordinary high flows following storm events.

2. Effects on Chemical and Physical Properties of the Water Column

Disposed material would be composed of natural gravel and sand found in the river. Disposal is not expected to affect the chemical or physical properties or the water column. The material is inert sand and gravel.

a. Light Penetration

Light penetration would be interrupted, but this affect is expected to be short term and highly localized. The affect would be limited to a few hours duration of the discharge. On completion, light penetration would return to background.

b. Dissolved Oxygen

There would be no affect on dissolved oxygen. The dredge material is inert and would have no affect on biological or chemical oxygen demand.

c. Toxic Metals and Organics

The TVA ecological health rating in 2000 noted that Kentucky Reservoir sediment was free of pesticides and PCBs. Concentrations of metals were within background levels. Due particle size contaminants would not be expected to adhere to the sand and gravel.

d. Pathogens

Pathogens would not be released into the water column. The dredge material consists of natural sand and gravel. Pathogens do not readily adhere to large inert particles.

e. Aesthetics

Some turbidity and suspended solids would affect the aesthetics of the water column. These affects are localized and temporary. On completion, the aesthetics of the water column would return to pre-experiment conditions.

f. Others as Appropriate

The aesthetics of the river view would be temporarily affected by the visual appearance of the dredging vessel, barges, equipment, boats, and diving activities. This effect would only last as long as it takes to complete the experiment.

3. Effects on Biota

a. Primary Production, Photosynthesis

There could be localized decreases in primary production and photosynthesis due to slight increases in suspended solids and turbidity. This effect would be short term and minor. In perspective, any disruption to primary production within the experimental site would negligible with respect to the size of the Tennessee River where primary production would continue to occur.

b. Suspension/Filter Feeders

There could be some mortality of suspension or filter feeders during maintenance dredging activities. These organisms could be impacted by the localized increases in suspended solids and turbidity. The effects would be temporary and localized. In perspective, any disruption to suspension/filter feeders within the experimental site would negligible with respect to the size of the Tennessee River where these organisms would continue to feed.

c. Sight Feeders

Sight feeders can avoid the immediate area. Disruption is expected to be minor and temporary. Sight feeders would be expected to return to the area when the proposed action is completed.

4. Actions Taken to Minimize Impacts

The original experimental protocols have been redesigned to minimize impacts to the biota. The amount of area disturbed would be limited to an approximate surface area of about ¼ acre. In perspective, the disturbance would be limited and localized in with respect to the size of the Tennessee River.

D. Contaminant Determinations

Data collected by TVA in 2000 indicated that Kentucky Reservoir sediments were free of pesticides and PCBs. Metal concentrations were within background levels. Due to the type and particle size of the material (natural sand and gravel) contaminants would not be expected to adhere to the dredged material.

E. Aquatic Ecosystem And Organism Determinations

1. Effects on Plankton

Minimal effects would be possible as a result of brief increases in suspended solids and turbidity. Plankton may be temporarily disturbed, however the effects would be temporary, localized, and negligible. Plankton are ubiquitous and would be expected to drift back into the area on completion of the activities.

2. Effects on Benthos

The immediate effect would be physical. Benthic organisms would be dislodged, relocated, and covered. Some would probably be injured and crushed. This effect is unavoidable. This affect would be limited to the test footprints. The original community structure would be altered. However, the composition of the substrate is not expected to change. Re-colonization by an equivalent benthic community is expected.

3. Effects on Nekton

Affects on nekton would be localized, short-term, and negligible. Nekton are mobile and would likely avoid the area. They are expected to return on project completion.

4. Effects on Aquatic Food Web

Disruption to the aquatic food web would be negligible, localized, and short-term. The experiment would affect a small area as compared to the size of the rest of the Tennessee River where the aquatic food web would not be disturbed. Effects are expected to dissipate on project completion.

5. Effects on Special Aquatic Sites

a. Sanctuaries and Refuges

The proposed activities would not be expected to affect sanctuaries or refuges. The closest mussel sanctuary is be located approximately 7 miles upstream.

b. Wetlands

No wetlands as defined in 33 CFR 323.2 (c) would be affected by this proposed work. The proposed work occurs in open water.

c. Mud Flats

There would be no affect. There are no mud flats.

d. Vegetated Shallows

There would be no affect. The proposed work occurs in open water.

e. Coral Reefs

No coral reefs exist. The Tennessee River is a freshwater system.

f. Riffle and Pool Complexes

The Tennessee River is a large deep regulated system. These features would not be found in an impoundment.

6. Threatened and Endangered Species

Pink mucklets (*Lampsilis abrupta*) and one Fanshell (*Cyprogenia stegaria*) have been found in the area. A Biological Opinion was issued on November 13, 2003 and it concluded that the 2004 experiment was not likely to jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat.

7. Other Wildlife

Terrestrial animals would be potentially disturbed by the noise and activities. However disturbance would be localized and temporary. Terrestrial animals would be mobile enough to avoid the area. They would be expected to return on project completion.

8. Actions Taken to Minimize Impacts

A detailed protocol has been developed to implement the 2004 experiment. The amount of area disturbed would be limited and localized in comparison to comparable benthic habitat within the rest of the Tennessee River. Preliminary surveys would be used to locate possible listed species and removed them from impact.

F. Proposed Disposal Site Determination

1. Mixing Zone Determinations

Mixing zones comprise a limited area or volume of water where a discharge plume would be progressively diluted by the receiving water. The discharge plume consists of predominantly sand and gravel. Slight increases in suspended sediment and turbidity would be highly localized and short-lived. The effects would be negligible in comparison to the high level of turbidity and suspended solids that occur during high flow events.

2. Determination of Compliance with Applicable Water Quality Standards

The experiment would be implemented in compliance with the State of Tennessee's water quality standards[R1]. This includes the narrative criteria for turbidity. Water Quality Certification (Aquatic Resource Alteration Permit -ARAP) was issued for the 2004 experiment on March 10, 2004.

3. Potential Effects on Human Use Characteristics.

There would be no major effect on navigation, boating, wildlife viewing, or any other human use. The Tennessee River is large and these activities can occur elsewhere in the river. On project completion, disturbance to these activities would cease.

a. Municipal and Private Water Supply.

No water supply intake would be affected by the experiment. The nearest water intake is located about 2 miles downstream the experimental area.

b. Recreational and Commercial Fisheries.

The proposed work would have minor adverse impacts on fishing opportunities during implementation. Anglers would avoid the area due to increased activities but would be expected to return on project completion.

Commercial mussel harvests could be slightly affected since some of the mussel community would be relocated with some individuals buried. This effect would be small given the availability of large harvest areas in the vicinity (Diamond and Wolf Islands). Marked mussels would be used in the experiment and may be susceptible to harvesting.

c. Water Related Recreation.

The increased noise, equipment, and personnel working in the area would temporarily disturb recreation. However, river traffic would continue to move freely within the navigation channel. These effects would cease on project completion.

d. Aesthetics.

The affect on river aesthetics would be temporary. On project completion, vessels, boats, barges, and personnel would leave the area and the river view would be restored.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, and Similar Preserves.

The experiment is not expected to affect any of these areas. The closest historical landmark, Shiloh National Park, is located approximately 3 miles upstream.

G. Determination Of Cumulative Effects On The Aquatic Ecosystem

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the (proposed) action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7)”. Council for Environmental Quality (CEQ) guidance identifies an 11-step process for evaluating cumulative effects.

The assessment can be defined by “what resource goals is the proposed action going to affect.” Effects can result from either direct-project related, indirect-project related, and

independent indirect causes. Based on the public and agency scoping and review performed for the previous NEPA documents conducted for this experiment, the significant resources identified are the freshwater mussels.

The geographic area covered by this cumulative effects evaluation is the Tennessee River and its tributaries. The temporal boundaries range from the early 1900s to 2050.

Human actions within the last 75 years have exerted significant impacts on the aquatic ecosystem. Populations demanded hydropower, improved navigation, water supply, flood control, recreation, and flow augmentation for wastewater assimilation. To support these demands, the river was altered from a free-flowing river system to a slower and deeper reservoir system with the construction of dams. Dams have been built for several millennia. However, dams built within the last 75 years were built on a large enough scale to alter the biotic and abiotic characteristics of the impounded river sections resulting in a distinct type of ecosystem (Watters, 1999).

Over this time period, endemic freshwater mussels were arguably hit hardest by the cumulative impact resulting from the physical and water quality changes in the impounded river system. Species that could not adapt to the new flow regime, water quality, and fine-grained habitat were threatened or extirpated altogether. Several species have become extinct. Historically, 297 species of mussels existed. Of the remaining 276 species nearly one-fifth are listed as endangered or threatened (Cope and Waller, 1995). Consequently, any activity affecting mussels or their habitat is a concern.

Mussels may be characterized as tending to stay in the same general location once established in a suitable habitat (Neddeau et.al., 2000). Because of this limited lifestyle, it is best for the mussels to avoid them. Where mussels cannot be avoided, impacts can be minimized. Mussels can be hand collected and relocated by divers. The need for relocation may be caused by instream construction activities, bridge construction, dredging and channel maintenance or other instream disturbances. Sometimes mussels are relocated to supplement other populations or re-colonize areas where mussels previously existed (Jenkinson and Todd, 1997; Federal Register, 2001). Mussel relocation has been used as a conservation and management tool for several decades (Cope et. al, 2002). Cope and Waller (1995) reviewed 37 relocations and found that the number of individual relocated mussels ranged from 44 – 18,300. However, it is possible to remove larger numbers of mussels. Sickel and Burnett (2001) were able to collect, identify, count, and relocate 53,803 mussels over a 3-week period. These individuals were concentrated in approximately 1 acre, and the relocation site was less than 0.25 miles away.

Mussel relocation has been used as a conservation and management tool for several decades. The overall effect of mussel relocation appears to be beneficial. Mussels that probably would have been destroyed by instream disturbances were rescued. Redistributing populations reduced the risk of endangering a species in the event of a localized spill or die-offs. Relocated mussels can augment existing populations or re-

establish populations within historic ranges (Cope and Waller, 1995; Nedeau et. al., 2002; Federal Register, 2001).

Reasonably foreseeable future actions that will affect this resource include continued water quality concerns, maintaining segmentation of the waterway by dams, maintenance dredging, sand and gravel mining, growing development of the watershed and associated erosion and sedimentation problems, municipal and industrial point source discharges, and increased use of the river for transportation and recreation. It is unlikely that any of these stressors will change. Some of the listed stressors can be expected to increase over time. It is therefore also reasonable to assume that mussel relocations will continue as a means to minimize impact to the resource. Relocation efforts might consider the experimental mussel relocation method as an alternative to diver removal and relocation when realistic and practical limitations such as time, experience, labor, funding, area impact size, and enormous mussels numbers affect the collection effort

As noted above, the maximum affected area encompassed by this experiment is about ½ acre. Compared with the area of equivalent benthic habitat within the Tennessee River, the effect of this experiment would be insignificant. All possible mitigation measures identified by the resource agencies have been incorporated into the experiment's redesigned protocols, and two formal monitoring events have been planned to evaluate the success or failure of the experiment.

H. Determination Of Secondary Effects On The Aquatic Ecosystem

If under some conditions, the experimental mussel relocation method can be considered for relocating large numbers of mussels, then it would be a second tool to add to conservation and management efforts.

III. Findings Of Compliance Or Non-Compliance With The Restrictions on Discharge

A. Adaptation of The Section 404(B)(1) Guidelines to this Evaluation

No adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

B. Evaluation of Availability Of Practicable Alternatives To The Proposed Discharge Site, Which Would Have Less Adverse Impact On The Aquatic Ecosystem

The proposed discharge site was selected because it is located in an area permitted sand and gravel extraction. The experiment would result in minimal additional adverse impact in an area already disturbed by extraction and mussel harvesting activities.

C. Compliance With Applicable State Water Quality Standards

Water quality standards set by the State of Tennessee and any special conditions delineated in the state Water Quality Certification (ARAP) would be followed. Certification was received on March 10, 2004.

D. Compliance With Toxic Effluent Standard Or Prohibition Under Section 307 Of The Clean Water Act

The experiment would not violate Section 307 of the Clean Water Act.

E. Compliance With The Endangered Species Act Of 1973

Coordination and consultation procedures with the U.S. Fish and Wildlife Service have been followed and were completed on November 13, 2003.

F. Compliance With Specified Protection Measures For Marine Sanctuaries Designated By The Marine Protection, Research, And Sanctuaries Act Of 1972

Not applicable. The proposed activities are located outside of these areas.

G. Evaluation of Extent of Degradation of the Waters of the United States

1. Significant Adverse Effects on Human Health and Welfare

The proposed actions would not result in any significant adverse impacts on human health and welfare.

a. Municipal and Private Water Supply

No municipal or private water supplies would be affected by the proposed activities. The nearest water intake is located 2 miles downstream the experimental site.

b. Recreational and Commercial Fisheries

The experiment is not expected to have any long-term adverse affect on fisheries or mussels. The total amount of surface area affect is approximately ½ acre. This area is small in comparison to the miles of Tennessee River open to commercial mussel harvesting and recreational and commercial fisheries.

c. Plankton

The effect on plankton is negligible. Plankton are ubiquitous and would drift into the action area unhindered on project completion.

d. Fish

Fish would likely avoid the area, but would to return on project completion.

e. Shellfish

The experimental relocation method would disturb, dislodge, and relocate mussels and other benthic organisms. Some benthic animals could be injured, killed or buried. As with any relocation effort, some mortality is expected and is unavoidable. The top layer of the original substrate would be altered, however, the composition of the sand and gravel habitat is not expected to change and it is therefore expected that equivalent benthic communities would re-colonize the test footprints.

f. Wildlife

Wildlife could be disturbed by increased noise and human activity associated with

the experiment. However this affect is temporary and localized. Disturbance would cease on completion of the experiment.

g. Special aquatic sites

The proposed work would not occur within any special aquatic sites.

2. Significant Adverse Impacts on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

The proposed action would have no major adverse impacts on life stages of aquatic life and other wildlife dependent on aquatic ecosystems. The experiment has been rescheduled for the fall to avoid major spawning and rearing activities associated with young life stages.

3. Significant Adverse Impacts on Aquatic Ecosystem Diversity, Productivity, and Stability

The proposed action would have no major adverse impacts on aquatic ecosystem diversity, productivity, or stability. Any effects within the experimental area would be small in surface area as comparison to equivalent habitat within the Tennessee River aquatic ecosystem.

4. Significant Adverse Impacts on Recreational, Aesthetic, and Economic Values

Any hindrance to recreation, aesthetic views, commercial sand and gravel extraction, or commercial mussels harvests would be minimal considering there are several other places within the Tennessee River that these activities occur.

H. Appropriate And Practicable Steps Taken To Minimize Potential Adverse Impacts Of The Discharge On The Aquatic Ecosystem

The experiment was rescheduled to occur in the early fall when low river flows are expected to minimize turbidity and suspended solids. This time window avoids fish and mussel spawning. Preliminary surveys would be conducted to remove mussels not used in the experiment out of the test footprints. The amount of discharge is small (approximately 100 cubic yards). The material would be disposed in a thin layer over the original substrate. The total surface area affected is small (approximately a total of ½ acre). The water temperature is expected to be at or above 60° F. At this water temperature, mussels tend to be mobile enough to reposition themselves in disturbed substrate.

I. On The Basis Of The Guidelines, The Proposed Disposal Site For The Discharge Of Dredged Or Fill Material Is

Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

References:

- Cope, W.G., and D.L. Waller. 1995. *Evaluation of Freshwater Mussel Relocation as a Conservation and Management Strategy*. Regulated Rivers: Research & Management, Vol. 11, 147-155.
- Cope, W.G., and M.C. Hove, D.L. Waller, D.J. Hornbach, M.R. Bartsch, L.A. Cunningham, H.L. Dunn, and A.R. Kapuscinski. 2002. *Evaluation of Relocation of Unionid Mussels to In Situ Refugia*. Journal of Molluscan Studies, 69:27-34.
- Federal Register. November 29, 1978. 40 CFR Parts 1500-1508. *Regulations For Implementing the Procedural Provisions Of The National Environmental Policy Act*. As of July 1, 1986.
- Federal Register. June 14, 2001. 50 CFR Part 17. *Endangered and Threatened Wildlife and Plants; Establishment of Nonessential Experimental Population Status for 16 Freshwater Mussels and 1 Freshwater Snail (Anthony's Riversnail) in the Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL*.
- Jenkinson, J. J., and R. M. Todd. 1997. *Management of Native Mollusk Resources*. Chapter 12, in *Aquatic Fauna in Peril: The Southeastern Perspective*. Edited by George W. Benz. 554 pp.
- Nedeau, E.J., M.A. McCollough, and B.I. Swartz. 2000. *The Freshwater Mussels of Maine*. 118 pp.
- Sickel, J. B., and M. D. Burnett. 2001. *Mussel Relocation from Two Proposed Fishing Jetty Sites Downstream from Kentucky Lock and Dam, Tennessee River Mile 21.6, Marshall Co., KY*. 60 pp
- Watters, G. T. 1999. *Freshwater mussels and water quality: A review of the effects of hydrologic and instream habitat alterations*. Proceedings of the First Freshwater Mollusk Conservation Society Symposium, pages 261-274. © 2000 Ohio Biological Survey.

Appendix C

Section 401 Water Quality Certification



DEPARTMENT OF ENVIRONMENT & CONSERVATION

Division of Water Pollution Control

401 Church Street
7th Floor, L & C Building
Nashville, TN 37243-1534

March 10, 2004

Nashville District Corps of Engineers

Attn: Ms. Joy Broach

Planning Branch (PM-P)

P. O. Box 1070

Nashville, Tennessee 37202-1070

SUBJECT: §401 Water Quality Certification
State of Tennessee Application # NRS03.278

Dear Ms. Broach:

Pursuant to §401 of the Federal Clean Water Act (33 U.S.C. §1341), the State of Tennessee is required to certify whether the activity described below will violate applicable water quality standards. Accordingly, the Division of Water Pollution Control requires reasonable assurance that the activity will not violate provisions of *The Tennessee Water Quality Control Act of 1977* (T.C.A. § 69-3-101 et seq.) or of §§ 301, 302, 303, 306 or 307 of *The Clean Water Act*.

Subject to conformance with approved plans, specifications, and other information submitted in support of the referenced application, the State of Tennessee hereby certifies the activity described under authorized work below pursuant to 33 U.S.C. 1341. This shall serve as authorization pursuant to T.C.A. § 69-3-101 et seq.

AUTHORIZED WORK: The authorized work includes experimental relocation of mussels to determine a method to be used to move large mussel beds prior to unavoidable maintenance dredging. The authorized work would use dredging equipment (clamshell dredge bucket and dump scow) and modified dredging techniques to move approximately 100 cubic yards of coarse sand and gravel containing resident mussels. This volume would be one-tenth of the river substrate volume disturbed during the 2002 experiment (1,000 cubic yards). The proposed activities would occur in close proximity to existing test dredge and disposal sites located within the proposed experimental site. The concept of this experimental removal method would be analogous to sod cutting operations. Two dredge bucket treatments would be used. Treatment 1 would involve dredging approximately the top one-foot of river substrate. Treatment 2 would involve dredging the top 3-feet of river substrate. For both treatments, material would be placed in one layer, to fill the bottom of a dump scow. The dredged material would be maintained in a wet condition. The dredged material would be disposed in a thin layer at the test disposal site so as not to bury mussels. Divers would collect information on mussel survival, damage, and condition at both, the test dredged and disposal sites.

LOCATION: Tennessee Rivers Mile (TRM) 194.0, (35° 12' 24"N; 88° 18' 42"W) and 195.0 (35° 11' 32"N; 88° 18' 33"W) approximately 100 feet off shore along the Left Descending Bank, Hardin County, Tennessee.

EFFECTIVE DATE: March 10, 2004

March 10, 2004

EXPIRATION DATE: March 10, 2009

SPECIAL CONDITIONS:

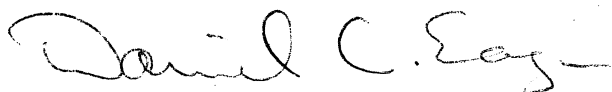
1. The work shall be accomplished in conformance with the approved plans, specifications, data and other information submitted in support of the above application and the limitations, requirements, and conditions set forth herein.
2. All work shall be carried out in such a manner as will prevent violations of water quality criteria as stated in Rule 1200-4-3.-03 of the Rules of The Tennessee Department of Environment and Conservation. This includes but is not limited to the prevention of any discharge that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the State for any of the uses designated by Rule 1200-4-4. These uses include fish and aquatic life, livestock watering and wildlife, recreation, irrigation, industrial water supply, and domestic water supply.
3. Appropriate steps shall be taken to ensure that petroleum products or other chemical pollutants are prevented from entering waters of the state. All spills must be reported immediately to the appropriate emergency management agency. Measures shall be taken immediately to prevent the pollution of waters of the State.

This does not obviate requirements of other federal, state or local laws. In particular, work shall not commence until the applicant has received the federal §404 permit from the U. S. Army, Corps of Engineers or §26a permit from the Tennessee Valley Authority where necessary.

The State of Tennessee reserves the right to modify or revoke this permit or to seek modification or revocation should the State determine that the activity results in violation of applicable water quality criteria or violation of the Act. Failure to comply with permit terms may result in penalty in accordance with § 69-3-115 of the Act.

An appeal of this action may be made to the Water Quality Control Board. In order to appeal, a petition requesting a hearing before the Board must be filed within 30 days after receipt of the permit action. In such petition, each contention should be stated in numbered paragraphs that describe how the proposed activity would be lawful and the action of the state is inappropriate. The petition must be prepared on 8½" by 11" paper, addressed to the Water Quality Control Board and filed in duplicate at the following address: Paul E. Davis, Director, Division of Water Pollution Control, 6th Floor L & C Annex, 401 Church Street, Nashville, Tennessee 37243-1534. Any hearing would be in accordance with T.C.A. §69-3-110 and 4-5-301 et seq. Questions concerning this certification should be addressed to Mr. Robert Baker at 615-532-0710.

Sincerely,



Paul E. Davis
Director

cc: Tom Welborn, U.S. Environmental Protection Agency, Atlanta, GA.
Lee Barclay, U.S. Fish & Wildlife Service, Cookeville, TN
Dan Sherry, Tenn. Wildlife Resources Agency, Nashville, TN
Pat Patrick, Water Pollution Control Division, Jackson Environmental Assistance Center

Appendix D

Public Notice, Comments and Responses



**US Army Corps
of Engineers.**

Public Notice

Public Notice No. **PM-P 03-02**

Beginning Date: **November 19, 2003**
Closing Date: **December 19, 2003**

Please	Nashville District Corps of Engineers	NEPA Administration	OR	Tennessee Division of Water Pollution Control
Address	P.O. Box 1070 (PM-P)	Tennessee Valley Authority		Natural Resources Section
Comments	110 Ninth Avenue South, Room 449A	400 West Summit Hill Drive		401 Church Street; 7 TH Floor L & C Annex
To:	Nashville, TN 37202-1070	Knoxville, TN 37902		Nashville, TN 37134-0343
	Contact: Ms. Joy Broach	Contact: Mr. Harold Draper		Contact: Mr. Dan Eagar
	Phone: 615-736-7956	Phone: 865-632-6889		Phone: 615-532-0708

JOINT PUBLIC NOTICE

US ARMY CORPS OF ENGINEERS TENNESSEE VALLEY AUTHORITY AND STATE OF TENNESSEE

SUBJECT: Proposed 2003 Experiment to relocate mussels between Tennessee Rivers Mile (TRM) 194.0, (35° 12' 24"N; 88° 18' 42"W) and 195.0 (35° 11' 32"N; 88° 18' 33"W) approximately 100 feet off shore along the Left Descending Bank, Hardin County, Tennessee.

TO ALL CONCERNED: In compliance with Section 404 of the Clean Water Act (CWA) PL 92-500, notice is hereby given that the Nashville District Corps of Engineers and the Tennessee Valley Authority propose to discharge dredged material into waters of the United States as described below. Before the work can be performed, Water Quality Certification (Aquatic Resource Alteration Permit) must be obtained from the State of Tennessee, Department of Environment and Conservation, Division of Water Pollution Control, Natural Resources Section, pursuant to Section 401(a)(1) of the CWA, documenting that applicable water quality standards would not be violated. By copy of this notice, the Corps of Engineers and the Tennessee Valley Authority hereby apply for the required water quality certification.

APPLICANT: **U.S. Army Corps of Engineers**
Nashville District
P.O. Box 1070 (PM-P)
Nashville, TN 37202-1070
Contact: Joy Broach (615-736-7956)

WATERSHED AND LOCATION: The proposed 2003 experiment would be conducted within the Upper Kentucky Reservoir Watershed (U.S. Geological Survey Hydrologic Unit Code 06040001). The general project location (Figure 1.) and proposed experimental site (Figure 2.) can be located on a USGS 7.5 Minute Series Quadrangle named

Pittsburg Landing, 13 NE. The proposed experimental site would be located just upstream of Crump, Tennessee, between TRM 194.0 and 195.0, about 100 feet off shore in open water, on the Left Descending Bank. This river segment averages 800 feet wide, and flow is regulated by Pickwick Lock and Dam (TRM 206.7). The river substrate consists of cobble, gravel, and sand. This river segment is currently permitted for commercial sand and gravel extraction and mussel harvesting. According to the 2002 Tennessee 305(b) report, this river segment supports all designated uses (Domestic water supply, Industrial Water Supply, Fish & Aquatic Life, Recreation, Irrigation, Livestock Watering & Wildlife, and Navigation).

PURPOSE AND DESCRIPTION: The purpose of this 2003 experiment would be to determine if this experimental mussel relocate method could be used to move large mussel beds prior to unavoidable maintenance dredging. The Proposed Action Alternative would use dredging equipment (clamshell dredge bucket and dump scow) and modified dredging techniques to move approximately 100 cubic yards of coarse sand and gravel containing resident mussels. This volume would be one-tenth of the river substrate volume disturbed during the 2002 experiment (1,000 cubic yards). The proposed activities would occur in close proximity to existing test dredge and disposal sites located within the proposed experimental site. The concept of this experimental removal method would be analogous to sod cutting operations. Two dredge bucket treatments would be used. Treatment 1 would involve dredging approximately the top one-foot of river substrate. Treatment 2 would involve dredging the top 3-feet of river substrate. For both treatments, material would be placed in one layer, to fill the bottom of a dump scow. The dredged material would be maintained in a wet condition. The dredged material would be disposed in a thin layer at the test disposal site so as not to bury mussels. Divers would collect information on mussel survival, damage, and condition at both, the test dredged and disposal sites.

Experimental protocols were used to implement the 2002 experiment. During a 2002 review, data gaps and Quality Assurance/Quality Control concerns were identified. As a result, the experimental protocols for the 2003 experiment have been redesigned and reviewed by the Tennessee Wildlife Resources Agency, Tennessee Department of Environment and Conservation, U.S. Fish and Wildlife Service, U.S. Geological Survey, Tennessee Valley Authority, and the Corps to capture missing information and to minimize impacts to the mussels.

Populations of freshwater mussels are known to inhabit the proposed experimental site. During the 2002 experiment, four Pink muckets (*Lampsilis abrupta*) and one Fanshell (*Cyprogenia stegaria*) were collected. The individuals were unharmed and handed over to the Tennessee Wildlife Resources Agency for further care. The Take was not exceeded (five Pink muckets and one Fanshell) and the 2002 experiment remained within the parameters outlined in the 2002

Biological Opinion dated September 9, 2002 that concluded that the 2002 experiment was not likely to jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat.

The surface area and volume of river substrate affected by the 2003 experiment has been considerably reduced, therefore it would be expected that encounters with listed species would also be reduced. The redesigned protocols would be expected to insure that the proposed 2003 experiment would not destroy or endanger any federally-listed threatened or endangered species or their critical habitats, as identified under the Endangered Species Act. Given the small scope of the 2003 experiment, and redesigned protocols, it would be anticipated that the Biological Opinion, Take, and findings for the 2003 experiment would be equivalent to documents issued for the 2002 experiment. The 2003 experiment has been coordinated through consultation with the U.S. Fish and Wildlife Service. Other federal, state and local approvals that may be required would include a Tennessee Valley Authority (TVA) Section 26a permit.

A copy of this Public Notice has been sent to the Tennessee State Historic Preservation Officer (SHPO). Evaluation of the proposed experimental site for the 2002 experiment revealed that no properties listed in or eligible for the National Register were known, that could be affected by the 2002 experiment. It would therefore be anticipated that the same findings would apply to the 2003 experiment that would be conducted within the same proposed experimental site. This review constitutes the full extent of cultural resources investigations unless comment to this notice is received documenting that significant sites or properties exist which may be affected by the 2003 experiment, or that adequately documents that a potential exists for the location of significant sites or properties within the proposed experimental site.

The No Action Alternative was also considered. This alternative would result in no federal action at this time. The 2003 experiment would not be conducted to assess the viability of using this experimental method as a means to move large numbers of mussels and their habitat in a timely, efficient, holistic (the whole community) way prior to unavoidable maintenance dredging.

PUBLIC PARTICIPATION: This notice serves to solicit comments, from the public; federal, state and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of the 2003 experiment. Any comments received by us would be considered to determine whether to perform the 2003 experiment. Comments would be used to assess impacts to endangered species, historic properties, water quality, water supply and conservation, economics, aesthetics, wetlands, flood hazards, floodplain values, land use, navigation, shore erosion and

accretion, recreation, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, general environmental effects, and in general, the needs and welfare of the people. Comments would also be used to determine the overall public interest of the proposed activity. The proposed experiment would be performed if the District Engineer determines that it would be in the public interest. In addition to consideration of other factors of the public interest, the review process would include application of the guidelines promulgated by the Administrator, Environmental Protection Agency (EPA), under authority of Section 404 (b)(1) of the Clean Water Act (40 CFR Part 230).

PUBLIC COMMENTS:

A 2003 Environmental Assessment (EA) and unsigned Finding Of No Significant Impact (FONSI), including Statement of Findings for this work, have been completed. Agencies and public responses received regarding the 2002 experiment have been incorporated. Additional comments received during this current Public Notice comment period would also be incorporated. This Public Notice serves as Notice of Availability of the 2003 EA and unsigned FONSI. A copy of the District Engineer's preliminary 404 (b)(1) evaluation will also be available for review and comment. Copies of these documents are available on request by contacting Joy Broach (615-736-7956) at the Corps of Engineers.

Persons wishing to review, comment on, or object to, this application should submit comments or requests, in writing, to either the Tennessee Department of Environment and Conservation, Division of Water Pollution Control, or Corps of Engineers at the addresses listed on the first page of this Public Notice. The public notice number, applicant name, and coordinator would be referenced. Written requests for a public hearing must also be filed within the comment period and must indicate the interest of the person requesting it, and the reason a hearing would be warranted.

Written statements must be received within the thirty-day comment period but no later than **December 19, 2003**. Written comments would become part of the record and would be considered in the determination.

Figure 1. Vicinity Map. Location of Experimental Site near Crump, Tennessee.

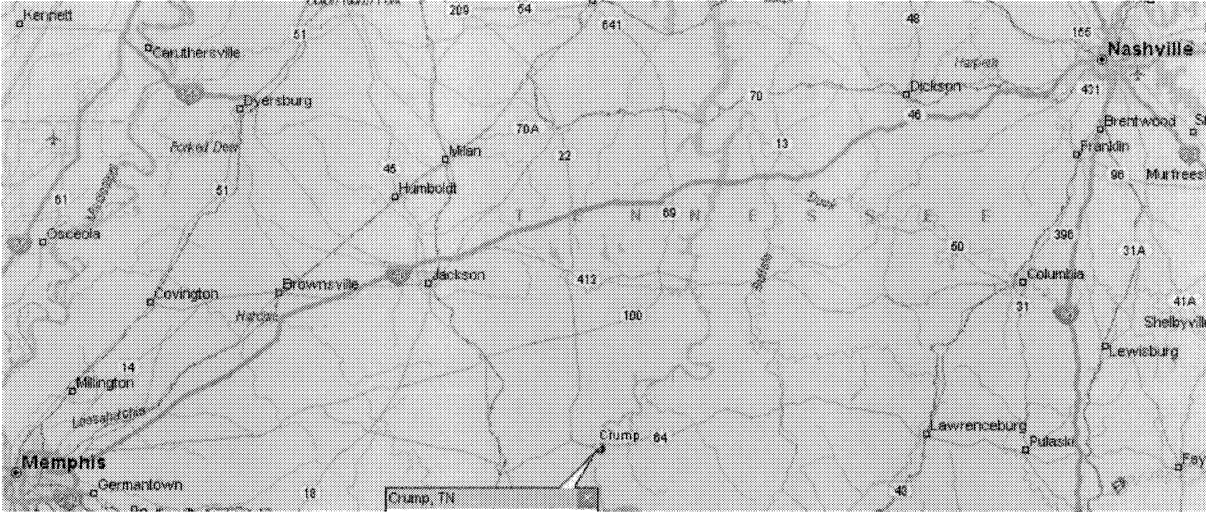
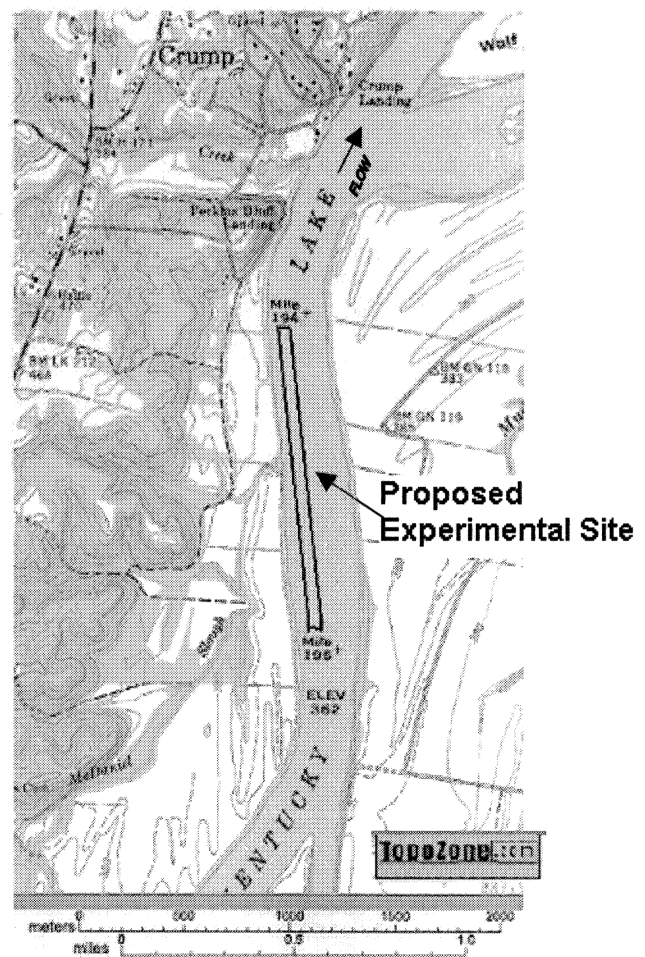


Figure 2. Experimental Site Location just upstream Crump, TN, between Tennessee River Miles 195.0 and 194.0, on the Left Descending Bank. Water depth would be variable depending on pool height and scow displacement.

USGS Topographic 7.5-Minute Series Map: 13 NE
Pittsburg Landing, TENN, 1972





TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

August 8, 2003

Ms. Joy Broach
U.S. Army Corps of Engineers, Nashville District
Regulatory Branch
3701 Bell Road
Nashville, Tennessee 37214

RE: COE-N, MUSSEL RELOCATION/TRM 194-195, UNINCORPORATED, HARDIN COUNTY

Dear Ms. Broach

The Tennessee State Historic Preservation Office has reviewed the above-referenced undertaking received on Thursday, July 31, 2003 for compliance by the participating federal agency or applicant for federal assistance with Section 106 of the National Historic Preservation Act. The Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation submitted, it is our opinion that there are no National Register of Historic Places listed or eligible properties affected by this undertaking. This determination is made either because of the location, scope and/or nature of the undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, this office has no objections to your proceeding with the project.

If you are applying for federal funds, license or permit, you should submit this letter as evidence of compliance with Section 106 to the appropriate federal agency, which, in turn, should contact this office as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to this office for comment. You may direct questions or comments to Jennifer M. Barnett (615) 741-1588, ext. 17. This office appreciates your cooperation.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jmb



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

REPLY TO
ATTENTION OF

August 8, 2003

Project Planning Branch

Dr. Lee A. Barclay, Supervisor
Ecological Services
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Dr. Barclay:

The U.S. Army Corps of Engineers - Nashville District (USACE), and the Tennessee Valley Authority (TVA) have proposed to conduct a 2003 experiment to determine if a clamshell dredge and dump scow can be used to relocate beds of native freshwater mussels prior to necessary channel maintenance dredging. On July 31, 2003, we issued a joint Public Notice (Number PM-P 03-02) describing this 2003 experiment.

The Public Notice (PM-P 03-02), 2003 Environmental Assessment (EA), Redesigned Experimental Protocols, Preliminary 404(b)(1) evaluation, and unsigned Findings Of No Significant Impact (FONSI), were mailed to your office on July 31, 2003. The EA was prepared in compliance with requirements of the National Environmental Policy Act and associated implementing regulations.

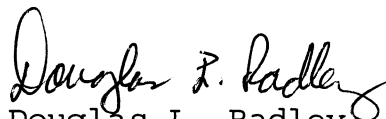
The 2003 EA provides new information found since the 2002 Experiment. Incomplete implementation of the 2002 protocols and data and quality assurance gaps resulted in a request from the Tennessee Wildlife Resources Agency to suspend continued experimentation pending redesign of the experimental protocols.

On February 13, 2003, an inter-agency meeting was conducted to discuss preliminary results of the 2002 experiment and to redesign the experimental protocols to address data gaps, detailed task instructions, and Quality Assurance/Quality Control measures. Agencies represented included the Tennessee Wildlife Resources Agency (TWRA), U.S. Geological Survey (USGS), Tennessee Valley Authority (TVA), U.S. Fish and Wildlife Service (USFWS), and the Corps of Engineers - Nashville District (Corps).

Preliminary results of the 2002 experiment revealed that one Fanshell (*Cyprogenia stegaria*) and four Pink mucketts (*Lampsyllis abrupta*) were collected during implementation of the 2002 experiment. All five individuals were found in good condition and handed over to TWRA for further care. While the Take for listed species was not exceeded during the 2002 experiment, the collection of these species indicate that formal consultation would be required for the 2003 experiment, in part to address the incidental take of five endangered mussels collected during the 2002 experiment. With this letter, TVA and the Corps request to initiate formal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act for the 2003 experiment. Information presented in Public Notice PM-P 03-02, the 2003 EA, Redesigned protocols, and preliminary results of the 2002 experiment support this request.

Please feel free to contact Ms. Joy Broach (at 615/736-7956) or Ms. Patty Coffey (615/736-7865) if your review of the referenced documents identify other concerns that should be addressed before these documents are finalized. Our intention is to collect sound scientific data by following the redesigned protocols during the 2003 experiment. The criteria to be used to evaluate the experimental results would be determined during meetings to review the findings with representatives from participating agencies (TWRA, USFWS, USGS, TVA, Corps, and the Tennessee Department of Environment and Conservation (TDEC)). We believe that adoption of the redesigned protocols would result in a useful evaluation of the experimental dredge removal technique and would reduce the potential effects on endangered mussel species to an insignificant level.

Sincerely,

A handwritten signature in cursive script, reading "Douglas L. Radley".

Douglas L. Radley, A.I.C.P.
Acting Chief, Project Planning Branch



United States Department of the Interior

FISH AND WILDLIFE SERVICE

446 Neal Street
Cookeville, TN 38501

August 22, 2003

Lieutenant Colonel Byron G. Jorns
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37202-1070

Attention: Ms. Joy Broach, Project Planning Branch

Dear Colonel Jorns:

This letter acknowledges the U.S. Fish and Wildlife Service's August 12, 2003, receipt of your August 8, 2003, letter requesting initiation of formal section 7 consultation under the Endangered Species Act. The consultation concerns the possible effects of your proposed mussel dredging experiment in the Tennessee River between River Miles 194.0 and 195.0 in Hardin County, Tennessee, on the federally endangered pink mucket pearly mussel (*Lampsilis abrupta*), orangefoot pimpleback (mussel) (*Plethobasus cooperianus*), fanshell (mussel) (*Cyprogenia stegaria*), white wartyback pearly mussel (*Plethobasus cicatricosus*), cracking pearly mussel (*Hemistena lata*), rough pigtoe (mussel) (*Pleurobema plenum*), and ring pink (mussel) (*Obovaria retusa*).

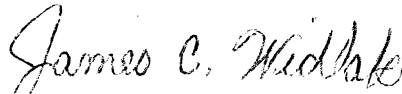
All information required of you to initiate consultation was either included with your letter or is otherwise accessible for our consideration and reference. We have assigned log number **03-1578** to this consultation. Please refer to that number in future correspondence on this consultation.

Section 7 allows the Service up to 90 calendar days to conclude formal consultation with your agency and an additional 45 calendar days to prepare our biological opinion (unless we mutually agree to an extension). Therefore, we expect to provide you with our biological opinion no later than December 26, 2003.

As a reminder, the Endangered Species Act requires that after initiation of formal consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice insures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

If you have any questions or concerns about this consultation or the consultation process in general, please feel free to contact Jim Widlak of my staff at 931/528-6481, ext. 202.

Sincerely,


for Lee A. Barclay, Ph.D.
Field Supervisor



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

REPLY TO
ATTENTION OF

SEP 16 2003

Project Planning Branch

Dr. Lee A. Barclay
Supervisor, Ecological Services
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Dr. Barclay:

We are in receipt of the U.S. Fish and Wildlife Service's (USFWS) letter, dated August 22, 2003, regarding the U.S. Army Corps of Engineers - Nashville District (USACE) and the Tennessee Valley Authority's (TVA) request for formal consultation (Log number 03-1578). The consultation concerns our proposal to conduct a 2003 experiment to determine if a clamshell dredge can be used to relocate native freshwater mussels prior to necessary channel maintenance dredging. This process would follow Redesigned Protocols developed during the inter-agency meeting on February 13, 2003.

The USFWS letter, dated August 22, 2003, states that Section 7 allows up to 135 calendar days to conclude consultation and prepare a biological opinion. This process would be completed no later than December 26, 2003. This date precludes implementation of the 2003 experiment during the fall of 2003. Due to weather constraints and the availability of USACE equipment, the next opportunity to perform this experiment would be during the first three weeks of April 2004, if the water temperature is 60°F or greater. We will seek guidance from the resource agencies - Tennessee Wildlife Resources Agency (TWRA), Tennessee Department of Environment and Conservation (TDEC), U.S. Geological Survey (USGS), and the USFWS - to help schedule a time window that is reasonable for all participating agencies.

In order to document short-term and long-term effects of this experiment, we propose two monitoring events for this experiment. The first monitoring event would occur 1 to 6 months following the proposed experiment. A second monitoring event would occur 3 to 12 months following the proposed experiment. Guidance would be sought from the above resource agencies to determine appropriate time frames to

implement monitoring. Monitoring would use the same qualitative and quantitative sampling techniques, outlined in the Redesigned Protocols, to evaluate the test dredge cut as well as the relocated mussels in the test disposal area. Information about long-term effects would be determined by examining survival and growth of small mussels and the reproductive condition of adult female mussels.

Our intention is for the Redesigned Protocols to be followed during this experiment. Qualitative and Quantitative sample techniques would be used in subsequent monitoring activities. Time frames would need to be scheduled for the proposed experiment and monitoring events. The criteria to be used during the evaluation of the experiment and monitoring results would be determined during meetings with representatives from the various participating agencies (USFWS, TWRA, TDEC, USGS, TVA, and USACE). We believe that adoption of these procedures would result in a useful evaluation of the dredge removal technique and would reduce the potential effects on endangered mussel species to an insignificant level.

Please feel free to contact Ms. Joy Broach (615/736-7956) or Ms. Patty Coffey (615/736-7865) if your review of the experimental proposal identifies other concerns that should be addressed before that document is finalized.

Sincerely,

David L. Day, Dep for Proj Mgmt
for Byron G. Jorns
Lieutenant Colonel
Corps of Engineers
District Engineer



United States Department of the Interior

FISH AND WILDLIFE SERVICE

446 Neal Street
Cookeville, TN 38501

November 13, 2003

Lieutenant Colonel Byron G. Jorns
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37214

Attention: Ms. Joy Broach, Project Planning Branch

Re: FWS #03-1578

Dear Colonel Jorns:

This document is the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed mussel relocation experiment in the Tennessee River, in the tailwaters of Pickwick Landing Dam, between Tennessee River Miles 194.0 and 195.0, left descending bank, Hardin County, Tennessee, and its effects on the endangered pink mucket (*Lampsilis abrupta*), fanshell (*Cyprogenia stegaria*), orangefoot pimpleback (*Plethobasus cooperianus*), white wartback (*Plethobasus cicatricosus*), rough pigtoe (*Pleurobema plenum*), ring pink (*Obovaria retusa*), and cracking pearlymussel (*Hemistena lata*) per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your August 8, 2003, request for formal consultation was received on August 12, 2003.

This biological opinion is based on information provided in the environmental assessment and other sources of information. A complete administrative record of this consultation is on file in the Service's Cookeville Field Office, 446 Neal Street, Cookeville, Tennessee 38501; telephone 931/528-6481.

You have also coordinated this proposed action in accordance with the provisions of the Fish and Wildlife Coordination Act. We believe that the proposed action will not have significant adverse impacts on fish and wildlife resources beyond those addressed in this biological opinion.

FWS Log No.: 03-1578
Date Started: August 12, 2003
Applicant: U.S. Army Corps of Engineers

Application No.: N/A
Ecosystem: Lower Tennessee-Cumberland
Action Agency: U.S. Army Corps of Engineers

Project Title: Experimental technique for relocation of freshwater mussel species by dredging
County: Hardin

Consultation History

August 2003: Project analysis, public notice, section 404(b)(1) evaluation, and environmental assessment submitted to the Service.

February 13, 2003: Inter-agency meeting in Nashville to develop approved protocols for the proposed experiment. The meeting was attended by representatives from the Nashville District Corps of Engineers (Corps), Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA), U.S. Geological Survey (USGS), and the Service.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is a second attempt at an experiment to determine if alternative methods are feasible for removing and relocating freshwater mussels from areas requiring maintenance dredging. The best method currently known for accomplishing such relocations is hand removal of mussels from dredge areas and hand placement in the relocation area by divers. In lieu of divers, the proposed experiment will employ a modified dredging operation to remove mussels and relocate them.

The proposed experiment will be conducted downriver from Diamond Island, between Tennessee River Miles 194.0 and 195.0. The proposed dredge site was selected because it is located within a disturbed river reach that is authorized for commercial sand and gravel extraction and commercial mussel harvest. A qualitative sweep of the area revealed that mussel density is lower than that in the originally proposed dredge area; thus, there may be a lower probability that federally listed mussel species inhabit the site. The disposal site was selected for the same reasons. The proposed dredge and disposal sites are each less than one-half acre in size. Dredge and disposal sites will be logged using Global Positioning System (GPS) and identified on topographic maps. A bathymetric survey will be conducted to map the sites, and temporary markers (e.g., anchors, chains, floats) will be used to mark the sites on the surface. Biologists from the Tennessee Wildlife Resources Agency and the Service have been invited to observe and participate in all aspects of the experiment; they will be allowed on board the dredge barge with required safety equipment (i.e., personal flotation device, hard hat, steel-toed shoes)(NOTE: we recognize that the Captain has the final authority and may deny access to his vessel on reasonable grounds).

Divers, using timed searches, will examine the dredge and disposal areas before dredging begins to collect qualitative and quantitative samples. The sample sites will be marked utilizing GPS, and all live mussels collected in the samples will be counted and identified. Twenty quantitative samples, using a 2.7 square foot quadrat, will be collected at each of two sites. Substrate removed from each quadrat will be brought to the surface and washed through a series of sieves in an effort to increase the likelihood of locating small mussel species and juvenile mussels in the substrate. All live mussels found in quadrat samples will be identified, counted, and measured, and density of mussels will be determined. A sub-set of non-listed species will be marked for the experiment. Marked mussels will be distributed, by hand-placing individual mussels into the substrate, in a pre-determined pattern over the test dredge site.

To determine efficiency and effect of mussel removal from the river bottom, a clamshell bucket will be used to remove one-to-three partial scoops and one-to-three full scoops of substrate from the dredge site. Each scoop will be placed on a flat barge (one at a time) and maintained in a wet condition. This material will be carefully inspected, and all living and recently damaged mussels that are observed will be removed by hand. Then, the dredged substrate will be shoveled onto a

series of nested screens and washed through with river water. Each screen will then be taken to a separate sorting table, the remaining mussels picked out, identified, counted, and measured by screen size. Portions of the sieved material will be re-examined to determine efficiency of mussel removal. All mussels will be placed in bags and maintained in good health; all Federal and State-listed species will be grouped and handled separately. After the clamshell dredging is completed and the conditions in the area are deemed safe, divers will collect up to eight 2.7 square foot quadrats from each test dredge area. The condition of the scoop depressions and other underwater conditions will be reported. Quadrat material will be placed into five-gallon buckets and brought to the surface for processing. Timed searches will be conducted by divers over each scoop depression after quadrats are collected. Each bucket will be processed in the same manner as the scoop samples.

For the actual experiment, the clamshell dredge bucket would be operated according to normal dredging procedures. Separate areas within the test footprints will be used to take full and partial scoops. Full and partial scoops will be placed separately in a single layer in one dump scow containing water. The scow will be transported to the dump site, aligned perpendicular to the riverbank, and slowly opened as it is backed away from the riverbank to deposit the material in a thin layer on the river bottom. Upon completion of dredging, divers will inspect the dredge sites; four 15 to 30 minute timed searches will be conducted to evaluate mussel removal efficiency and to collect any remaining and/or damaged mussels. After completion of disposal, a bathymetric survey will be conducted to map the new bottom topography at the disposal site. In addition, after the scow has left and conditions in the area are deemed safe, divers will conduct four 15 to 30 minute searches over the entire discernible disposal area. All freshly cracked, chipped, or broken shells will be brought to the surface. These shells will be processed in the same manner as the dredge samples.

Within 48 hours post-experiment, divers will collect twenty 2.7 square foot quadrats from within the disposal footprints. The location and position of mussels in the substrate will be recorded, particularly for any marked mussels collected. Quadrat material will be brought to the surface for processing. Samples will be processed in the same manner as all other samples. The disposal sites will be inspected again 12 to 14 months post experiment, or as advised by TWRA and/or Service biologists.

A progress report will be provided by the principal investigator to the Corps, TWRA, and the Service within two months of completion of the field surveys; a final report summarizing the results of the entire experiment will be provided within four months of completion of post-experiment monitoring. The reports will contain the results of the experiment, to include:

1. Survival rate of mussels within 48 hours and after 12 to 14 months
2. Percent survival of mussels in scoops undergoing detailed inspection
3. Percent efficiency of removal of mussels with a comparison of pre-and post-survey results

4. Percent mortality of mussels at the dredge site
5. Percent survival of mussels at the disposal site
6. Percent of mussels suffering non-lethal shell damage at time of collection

The Service has defined the action area to include the area that will undergo dredging (approximately 0.25 acres in size), the area on which the dredged material will be disposed (approximately 0.25 acres in size), and an additional 0.25 acre area adjacent to the dredge and disposal sites for reasons that will be explained and discussed in the "EFFECTS OF THE ACTION" section of this biological opinion.

STATUS OF THE SPECIES/CRITICAL HABITAT

The Tennessee River Basin contains one of the richest and most diverse freshwater mussel faunas in the world, including many endemic species. Because of its age and the fact that it did not undergo glaciation, the Tennessee River Basin has long been known as a primary center of mussel speciation. Over 100 species historically occurred and evolved in the Tennessee River and its tributaries. Since 1900, however, populations of many species have undergone significant declines, some have become extinct and others have been reduced to remnants restricted to isolated portions of their former ranges. Several species in the genus *Epioblasma* have not been recorded from any stream in the entire Tennessee or Cumberland River drainages for over 50 years and are presently believed to be extinct. At present, more than 60 species may still inhabit streams and rivers in the basin, 27 of which are federally listed as endangered species. Although some species occur in the main stem of the Tennessee River, many are restricted to the tributaries, and others are limited in range to the medium-sized and small headwater streams.

Some mussel species can be found in slow-flowing, mud-bottomed pool habitats, but the majority prefer shoal or riffle areas with relatively swift current over substrate consisting of mixed cobble, gravel, and sand. The current maintains a high dissolved oxygen content and sweeps the bottom clean of silt and other settleable materials. Freshwater mussels are, for the most part, sedentary. Unless they are dislodged or their habitat is de-watered, they probably remain in one place for life, although most mussels move vertically into and out of the substrate. Feeding is accomplished by filtering detritus, plankton, bacteria, and diatoms from the water column.

Gametogenesis in most species of mussels follows one of two annual cycles. Fertilization and development occurs in early spring in tachytictic (short-term) breeders. Glochidia are released in late spring through late summer. Fully developed glochidia are retained in the female's brood pouches over winter in bradytictic (long-term) breeders, and released the following spring.

The life cycle of mussels is unique. Sperm produced by the males are released into the water column and are siphoned from the water by females during normal respiration and feeding activity.

Fertilized eggs are stored in specially modified gills that act as brood pouches for the developing larvae, or glochidia. Fully developed glochidia are released into the water and within three or four days they must, as obligate parasites, attach to a suitable fish host, encysting on gill filaments, opercles, or fins. Varying levels of host specificity have been reported for a number of mussel species. Those glochidia not successfully attaching to a host fish probably settle to the bottom eventually and perish or serve as prey for fish or invertebrate predators. During the period of attachment to the host, which lasts up to several weeks depending on water temperatures and other factors, the glochidia metamorphose. Although they do not undergo significant growth, glochidia are thought to derive some nutrition from the host. When metamorphosis is complete, the glochidia detach from their host and eventually settle to the stream bottom as fully developed juvenile mussels. Two stages in this cycle are most critical: finding an appropriate host and settling into proper habitat after detachment. Significant mortality likely occurs at both stages as a result of glochidia not coming into contact with a suitable host, attaching to unsuitable hosts, and from newly metamorphosed juveniles settling into unsuitable habitat.

A number of factors have been identified as causes in the decline of freshwater mussel populations in the Tennessee River Basin. Construction of impoundments converted hundreds of miles of free-flowing riverine habitat to more lake-like conditions. Alteration of water temperature, reduction in flow, change in fish communities, and accumulation of sediment on reservoir bottoms eliminated significant populations of riffle-dwelling mussels. Suitable habitat for these species now exists only in the river reaches below the dams, and in unimpounded tributaries. However, coldwater releases from some of the dams have rendered their respective tailwaters uninhabitable by mussels. Although species of mussels that are tolerant of lentic conditions still exist in the upper reaches of some reservoirs, these communities are neither as abundant nor diverse as the shoal mussel communities that existed prior to impoundment.

Siltation is another cause in the decline of mussel species in the Tennessee River. Mussels naturally occurred in and adapted to conditions in streams that were subjected to periodic siltation from annual flooding cycles. However, silt loads resulting from construction, logging, agricultural activities, dredging, mining, and development are likely to be more prolonged and excessive than those from seasonal storm events. Some mussels have been found to react to suspended sediment by cessation of siphoning activity. This results in significant stress resulting from reduction in respiration and feeding. Adult, juvenile, and larval mussels may also be smothered by silt blanketing the stream bottom. Heavy silt may also smother eggs and fry of fish that serve as hosts, or cause adult fish to abandon a river reach.

Because of their sedentary nature and feeding habits, mussels are known to be particularly susceptible to pollution. Pollutants such as pesticides and metals are siphoned from the water by adult mussels and may result in direct mortality, or accumulate in the body tissues and be passed up the food chain. A pedal-feeding juvenile mussel may be exposed to pollutants by ingesting contaminated sediment and food items as it feeds in the substrate. Because they accumulate pollutants, mussels are considered to be excellent indicators of water quality.

Over the past ten to fifteen years, a series of significant mussel die-offs have been reported throughout the eastern United States. Causes are generally unknown, but mortality rates of up to 95 percent have been estimated for the mussel communities affected. From 1983 to 1985, a mussel die-off was observed by biologists and commercial mussel divers below Pickwick Landing Dam. Both commercially important and endangered species were observed dead and dying on the river bottom. If this phenomenon continues, further reductions in numbers and range for many mussel species may result.

In the late 1800's and early 1900's, mussels were collected for pearls and/or commercially harvested for their shells, which were used in the manufacture of pearl buttons. A minute percentage of mussels had commercially valuable pearls, and only the shells of certain species provided acceptable shell material. However, indiscriminate harvest from both activities caused significant, but localized, declines in many mussel stocks. Subsequent development of plastics reduced demand for shell buttons and resulted in reduction of commercial mussel harvest. However, shells of freshwater mussels are presently in demand for use in the cultured pearl industry. Commercial pressure is not as great as in the past and States that allow mussel harvest regulate the fishery through limitations on issuance of licenses and establishment of legal size restrictions. Most listed species are not commercially valuable, but they are occasionally taken during harvest of other species.

Species/critical habitat description

Pink mucket

The pink mucket, *Lampsilis abrupta*, was listed as an endangered species on June 14, 1976 (Service 1999). It is an Ohioan species with possibly the widest range known for a listed mussel. Historical records indicate that this species once occurred in large rivers in 12 states. Presently, known populations occur only in the Barren River, Big River, Black River, Clinch River, Cumberland River, Current River, Gasconade River, Green River, Kanawha River, Little Black River, Meramec River, Ohio River, Osage River, Paint Rock River, and Tennessee River (Service 1985, 1992; Parmalee and Bogan 1998). Of these extant populations, only a few have shown recent evidence of recruitment. Some taxonomists have recently postulated that the reproducing populations west of the Mississippi River are not *Lampsilis abrupta*, but rather are more closely related to another endangered species, the Higgins eye pearl mussel (*Lampsilis higginsii*). If this is true, then there are fewer known reproducing populations of *L. abrupta* than originally thought. Although it has a relatively wide distribution and is apparently more tolerant of reservoir-type habitat conditions than other listed mussel species, the pink mucket is reported to be rare where it occurs.

This species inhabits primarily shoal areas in large rivers with swift currents, depths of 0.5 to 8.0 meters (1.6 feet to 26.2 feet), and mixed sand/gravel/cobble substrate. Notwithstanding this, the pink mucket appears to have adapted to reservoir-type conditions in the upper reaches of some impoundments. Life history aspects of this species are presently unknown, although it is probably a long-term breeder, as are other *Lampsilis* species. The glochidia are undescribed and the fish host is unknown (Service 1985, 1992; Parmalee and Bogan 1998).

The pink mucket represents the most commonly encountered federally listed mussel in the Pickwick Landing Dam tailwater (Don Hubbs, personal communication). Live individuals have been recently collected from below Pickwick Landing Dam to the headwaters of Kentucky Lake. Six individuals were collected in the action area in 2002, and one was collected during a post-action monitoring survey in 2003.

There is no designated critical habitat for this species.

A recovery plan was approved for the pink mucket on January 24, 1985. This species will be considered recovered when:

1. Two additional viable populations are found in any two rivers other than the Tennessee River, Cumberland River, and Meramec River. Populations in those two rivers will be distributed such that a single catastrophic event would likely not result in elimination of the population. Survey data must show at least five viable populations with each having a minimum of two year classes between four and 10 years of age.
2. Additional mussel sanctuaries must be established or expanded in river systems containing known populations of the pink mucket.
3. An education program must be established for the public with major emphasis toward commercial mussel harvesters.
4. The species and its habitat are protected from present and foreseeable human-related and natural threats that might interfere with survival of any of the populations.

Fanshell

The fanshell, *Cyprogenia stegaria*, was listed as an endangered species on June 21, 1990 (Service 1999). It is another Ohioan species that was described as being a medium to large river mussel. Historically, it had a wide distribution in the Ohio, Wabash, Cumberland, and Tennessee River drainages. However, over the past 90 years, the species has undergone significant population declines throughout its range. Presently, reproducing populations are thought to occur only in the Clinch River, Hancock County, Tennessee, and Scott County, Virginia; the Green River, Hart and Edmonson Counties, Kentucky; and the Licking River, Kenton, Campbell, and Pendleton Counties, Kentucky. Nonreproducing, relic populations still exist in the upper Ohio River, Tennessee River, and possibly a small number of other streams (Patty Morrison, personal communication). Like the other species addressed in this opinion, the fanshell is an inhabitant of riffles and shoals in the mainstem of large rivers and their larger tributaries. (Parmalee and Bogan 1998; Service 1991b, 1992) The fanshell is a long-term breeder; females have been found to be gravid from late October to late May (Jones and Neves 2002). Seven species of darters and two species of sculpins were identified as suitable hosts for fanshell glochidia (Jones and Neves 2002). The fanshell historically

occurred in the Tennessee River below Pickwick Landing Dam, and a live individual was collected in the action area in 2002 (Don Hubbs, personal communication).

There is no designated critical habitat for this species.

A recovery plan was approved for the fanshell on July 11, 1991. This species will be considered recovered when:

1. Through protection of existing populations, successful establishment of reintroduced populations, and/or discovery of new populations, a total of 12 viable populations exist. Each population must be distributed such that a single catastrophic event would likely not result in elimination or significant reduction of more than one population. The 12 populations will be distributed as follows: two populations in the upper Tennessee River system, two in the middle-to-lower Tennessee River system, one in the Cumberland River system, three in a Kentucky tributary to the Ohio River other than the Cumberland River, one in the Allegheny River system, one in the lower Muskingum or Wauhatchie River system, one in the Kanawha River system, and one in the Wabash River system.
2. Two distinct, naturally produced year classes exist within each of the 12 populations. Both year classes must have been produced within 10 years, and one within five years, of the recovery date. Within one year of the recovery date, gravid females of the species and its host fish must be present in each river.
3. Biological and ecological studies must be completed, and recovery measures implemented from those studies must be successful. Success will be evidenced by an increase in population density and/or an increase in length of river reach inhabited by each of the 12 populations.
4. No foreseeable threats exist that would threaten the survival of any of the populations.
5. Noticeable improvements in water and substrate quality have occurred in currently degraded habitats.

Orangefoot pimpleback

The orangefoot pimpleback, *Plethobasus cooperianus*, was listed as an endangered species on June 14, 1976 (Service 1999). It is also an Ohioan species, but it is more widely distributed than *P. cicatricosus* (Parmalee and Bogan 1998; Service 1984a). Historically, the orangefoot pimpleback occurred in the Ohio, Kanawha, Wabash, Rough, Tennessee, Duck, French Broad, Holston, Clinch, and Cumberland Rivers. It was historically reported to be an abundant species in the Ohio, Wabash, and Cumberland Rivers; however, it was rare in the Tennessee River and its tributaries above

Knoxville. Presently, *P. cooperianus* is known to occur in the Tennessee River below Pickwick Landing Dam (Tennessee) and the lower Ohio River near Metropolis and Olmstead, Illinois, and McCracken County, Kentucky. Of these populations, only the one in the Tennessee River is known to be reproducing (Parmalee and Bogan 1998; Service 1984a). The orangefoot pimpleback is a large-river species. It is found in gravel and sand in water from 15 to 29 feet in depth. The species' life history is unknown, but gravid females have been collected during the summer, indicating that the species is a short-term breeder. The glochidia are undescribed and the fish hosts are unknown (Parmalee and Bogan 1998; Service 1984a).

Live individuals have been collected from the Tennessee River recently below Pickwick Landing Dam in the vicinity of Diamond Island, adjacent to Shiloh National Military Park, and downriver to Swallow Bluff Island.

No critical habitat has been designated for this species.

A recovery plan was approved for the orangefoot pimpleback on August 30, 1984. This species will be considered recovered when:

1. Viable populations exist in the Tennessee River, Cumberland River, and Ohio River. Each population must be distributed such that a single catastrophic event would not likely result in elimination of the entire population.
2. Through re-establishments and/or discoveries of new populations, viable populations exist in two additional rivers. Each population must be distributed such that a single catastrophic event would likely not result in elimination of the entire population. Re-established populations must exhibit successful natural reproduction-i.e., three naturally produced year classes must be present, including one year class 10 years old or older.
3. The species and its habitats are protected from present and foreseeable human-related and natural threats that might interfere with the survival of the populations.
4. Noticeable improvements in siltation problems and substrate quality have occurred.

White wartyback

The white wartyback pearly mussel, *Plethobasus cicatricosus*, was listed as an endangered species on June 14, 1976 (Service 1999). It is an Ohioan (Interior Basin) species occurring in the Ohio, Cumberland, and Tennessee River systems. Historical records indicate that the species occurred in the Tennessee River, Cumberland River, Ohio River, Holston River, Wabash River, and Kanawha River (Parmalee and Bogan 1998; Service 1984). It has always been uncommon throughout its range, and the only recent collections of this species have been from the mainstem of the Tennessee River. Young specimens have been found recently only in the Tennessee River below Wilson Dam

(Alabama). With only one known reproducing population, the white wartyback is extremely vulnerable to extinction. The white wartyback is a big-river species, inhabiting areas with sand and gravel substrate swept clean by river currents. Its life history is unknown, but it may be a short-term breeder as is its congener *P. cyphus*. Fish hosts for the species are also not known (Parmalee and Bogan 1998; Service 1984). Live individuals have been collected recently from the Tennessee River below Wilson Dam in Alabama and a single, old individual was collected below Pickwick Landing Dam in Tennessee.

No critical habitat has been designated for this species.

A recovery plan was approved for the white wartyback on September 19, 1984. This species will be considered recovered when:

1. A viable population exists in the Tennessee River. This population must be distributed such that a single catastrophic event would not be likely to result in the loss of the entire Tennessee River population.
2. Through re-establishments and/or discoveries of new populations, viable populations exist in two additional rivers. Each population must be distributed such that a single catastrophic event would not be likely to result in the loss of the entire population from the river. Additionally, each re-established population must exhibit successful natural reproduction-i.e., three naturally produced year classes must be present, including one year class 10 years old or older.
3. The species and its habitats are protected from present and foreseeable human-related and natural threats that would interfere with survival of the populations.

Rough pigtoe

The rough pigtoe mussel, *Pleurobema plenum*, was listed as endangered on June 14, 1976 (Service 1999). It is an Ohioan species that was historically widespread in the Ohio River, Cumberland River, and Tennessee River systems (Service 1984b). The rough pigtoe presently occurs only in the Tennessee River, Clinch River, Green River, and Barren River. In the Tennessee River, the species is thought to occur for an undetermined number of miles below Pickwick Landing (Tennessee), Wilson (Alabama), and Guntersville (Alabama) Dams, and is believed to be reproducing below Pickwick. It is also thought to be reproducing and recruiting in the Green River and Barren Rivers (Kentucky) and upper Clinch River (Virginia) (R.R. Cicerello personal communication; Parmalee and Bogan 1998; Service 1984b). The species' life history is not known, but studies completed on other *Pleurobema* species indicate that *P. plenum* is a short-term breeder. Fish hosts are unknown (Parmalee and Bogan 1998; Service 1984b).

Recent collections of this species have not been made from below Pickwick Landing Dam, but historical records are available (Bogan and Parmalee 1983).

There is no designated critical habitat for this species.

A recovery plan was approved for the rough pigtoe on August 6, 1984. This species will be considered successfully recovered when:

1. A viable population exists in the Tennessee River, Clinch River, Cumberland River, and Green River. Each of these populations must be distributed such that a single catastrophic event would likely not result in elimination of the entire population from the river.
2. Through re-establishments and/or discoveries of new populations, viable populations exist in two additional rivers. Each population must be distributed such that a single catastrophic event would likely not result in elimination of the entire population. Re-established populations must exhibit successful natural reproduction. Three naturally produced year classes must be present, including one year class 10 years old or older.
3. The species and its habitats are protected from present and foreseeable human-related and natural threats that might interfere with survival of any of the populations.
4. Noticeable improvements in siltation problems and substrate quality have occurred.

Ring pink

The ring pink, *Obovaria retusa*, was listed as an endangered species on September 29, 1989 (Service 1999). It is also an Ohioan species. Historically, it was a wide-ranging species, occurring in the Ohio, Cumberland, and Tennessee River systems. It is presently found only in the Green River in Edmonson and Hart Counties, Kentucky (R.R. Cicerello, personal communication; Parmalee and Bogan 1998). A relic population may survive in the Tennessee River below Pickwick Landing Dam, but no recent evidence of reproduction or recruitment has been reported for the Green River population and the continued existence of the Tennessee River population is questionable. The ring pink is a shoal species, inhabiting riffle areas with sand and gravel substrate. The species' fish hosts and life history are unknown (Parmalee and Bogan 1998; Service 1991).

Although it was thought to have been extirpated, live specimens were found below Pickwick Landing Dam, and live specimens have been collected from the Tennessee River below Kentucky Dam within the past 15 years (Bogan and Parmalee 1998). Additionally, a single live individual was recently collected in the Green River in Kentucky (J. Layzer, personal communication).

There is no designated critical habitat for this species.

A recovery plan was approved for the ring pink on March 25, 1991. This species will be considered recovered when:

1. Through protection of existing populations, successful establishment of reintroduced populations, and/or discovery of new populations, a total of at least nine Ohio River system tributaries contain viable populations. These populations will be distributed as follows: one population in Pennsylvania, one in Ohio, one in West Virginia, one in Indiana, one in Illinois, two populations in Kentucky (one in the lower Tennessee River or lower Cumberland River, and one in another Ohio River tributary such as the Green River), and two in Tennessee.
2. Biological and ecological studies have been completed, and recovery measures implemented from these studies have been successful. Success will be evidenced by an increase in population density and/or size, and increases in length of river reach inhabited within each of the nine populations.
3. No foreseeable threats exist that would threaten the survival of any of the nine populations.
4. Noticeable improvements in water and substrate quality have occurred in currently degraded habitats.

Cracking pearlymussel

The cracking pearlymussel, *Hemistena lata*, was listed as endangered on September 28, 1989 (Service 1999). It is an Ohioan species that historically occurred in the Ohio, Cumberland, and Tennessee River systems. However, it is currently known to persist in only two river reaches: the Clinch River in Hancock County, Tennessee, and Scott County, Virginia; and the Elk River in Lincoln County, Tennessee. The cracking pearlymussel inhabits riffle and shoal areas in medium-sized streams having gravel or mixed gravel/sand substrate. Reproductive characteristics and fish hosts for this species are also unknown. (Parmalee and Bogan 1998; Service 1991a, 1992) Although the species has not been collected from below Pickwick Landing Dam since 1980, it may still persist in low densities.

No critical habitat has been designated for this species.

A recovery plan was approved for the cracking pearly mussel on July 11, 1991. This species will be considered recovered when:

1. Through protection of existing populations, successful establishment of reintroduced populations, and/or discovery of new populations, a total of eight viable populations exist. Each population must be distributed such that a single catastrophic event would likely not result in elimination or significant reduction of more than one population. The eight populations will be distributed as follows: two populations in the upper Tennessee River system, two in the middle-to-lower Tennessee River system, one in the Cumberland River system, one in a Kentucky tributary to the Ohio River other than the Cumberland River, and two in the Wabash River system.

2. Two distinct, naturally produced year classes exist within each of the eight populations. Both year classes must have been produced within 10 years, and one within five years of the recovery date. Within one year of the recovery date, gravid females of the species and its host fish must be present in each river.
3. Biological and ecological studies must be completed, and recovery measures implemented from those studies must be successful. Success will be evidenced by an increase in population density and/or an increase in length of river reach inhabited by each of the eight populations.
4. No foreseeable threats must exist that would likely threaten the survival of any of the populations.
5. Noticeable improvements in water and substrate quality must occur in currently degraded habitats.

A list of previously completed biological opinions produced by biologists from this office for the species addressed in this biological opinion is attached.

ENVIRONMENTAL BASELINE

The Tennessee River in the action area has been subjected to numerous anthropogenic impacts (Tennessee River from River Mile 194.0 to River Mile 195.0). The river is heavily used by navigation traffic; a minimum depth navigation channel of nine feet is maintained in this unimpounded reach of the river. Periodic dredging has been needed to maintain the channel and keep it free of depositional materials; actions have also been taken in the past to remove rock outcroppings that extended into the channel and posed navigational hazards. Sand and gravel dredged from the channel are disposed of in the back chute of Diamond Island, approximately one mile to the south. Additionally, commercial sand and gravel dredging operations have occurred downriver at Wolf Island and, to a limited degree, upriver in the vicinity of Diamond Island.

The watershed adjacent to the action area is primarily rural and agricultural land. Cleared areas have likely contributed sediment to the river and affected the aquatic fauna. However, no urban, industrial, or residential developments exist along this reach of the river. Pickwick Reservoir likely acts as a catchment for discharges from the urban areas of Florence, Sheffield, and Muscle Shoals, Alabama; and the nearest urban area, Savannah, Tennessee, lies approximately five miles downriver. The action area is, therefore, somewhat protected from pollutants discharged from upriver urban areas.

EFFECTS OF THE ACTION

Imperiled mussels are often an issue with development activities that take place in streams. As a rehabilitation measure, mussels are commonly translocated from project sites into other habitats. To date, there appears to be a lack of information regarding success of mussel transplants, particularly information about whether or not transplanted individuals survive and reproduce (Dunn 1991). Several transplant studies have reported positive results, but many have reported relatively high levels of mortality at some transplant sites (Steve Ahlstedt; Richard Neves, personal communications). Furthermore, conclusive proof that mussel transplants do not adversely affect individuals or populations is lacking. To determine success apparently requires long-term monitoring, which most agencies are unable or unwilling to do. If relocated mussels exhibit low survival and little or no reproduction and recruitment, then transplants may actually cause adverse effects within populations, not avoid them. Therefore, it appears that, until research provides evidence that transplants of endangered mussels can and do succeed, protection of occupied habitat, even marginal habitat, may be the only means of avoiding adverse project impacts or jeopardy to the continued existence of endangered mussels. The proposed experiment addresses this research need.

- Direct/Indirect Effects

Effects to listed species resulting from the proposed action will be limited to the one-half acre dredging and disposal sites. Direct mortality to individual mussels could occur as a result of those mussels being crushed, cracked, or suffering other types of damage to the shell as the dredge scoops up substrate. Mussels suffering immediately non-lethal damage to the shells would also be directly affected, although mortality could likely occur subsequent to dredging.

Indirect effects also could occur at the disposal site. Mussels will be dumped from the barge with the dredged substrate at the disposal site, which contains suitable mussel habitat. Although only a small amount of material will be deposited at the disposal site, it will take an undetermined amount of time for each mussel to reposition itself in the substrate, and some may be unable to do so, perishing by suffocation. River currents could move some of these relocated mussels downriver into areas of unsuitable habitat.

In addition, indirect effects to mussels could result from handling. Mussels collected for data recording will be out of the water for some time while data are collected. This will cause stress to individual mussels that may or may not result in more serious effects or, potentially, mortality at a later time. Additionally, mussels dislodged during dredging and not relocated could perish later in time as a result of being swept into unsuitable habitat by river currents. Incidental drift of sand and fine sediment from the dredge and disposal sites could settle on adjacent areas and indirectly affect mussels.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The area in which the proposed action will be conducted is not currently being affected by development, and there are no major urban areas in the vicinity of the proposed mussel removal and relocation experiment. Large recreational boats and barge traffic that move upriver and downriver through the action area likely have some effect on the mussels; propeller wash creates waves that erode the riverbanks, resulting in sediment deposit on the river bottom. Runoff from adjacent agricultural fields may contain fertilizers and/or pesticides that can affect aquatic organisms, including mussels. These effects have occurred over many years and are likely to continue.

CONCLUSION

After reviewing the current status of the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, and rough pigtoe; the environmental baseline for the action area; the effects of the proposed experiment; and the potential cumulative effects; it is the Service's opinion that the proposed experiment to test the alternative method for removal and relocation of freshwater mussels prior to dredging operations is not likely to jeopardize the continued existence of the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, and rough pigtoe. No critical habitat has been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE

Section 9 of the Act and Federal regulation under section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. *Harm* is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. *Harass* is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to adhere to the terms and conditions of the incidental take statement and/or (2) fails to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates that incidental take of the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, and rough pigtoe will be difficult to detect for the following reasons: 1) no mussel population or density estimates are currently available for the areas to be dredged for the proposed experiment; 2) if one or more of the species addressed in this biological opinion occur in the action area, they exist in extremely low numbers; 3) dead or injured mussels are difficult to detect in a large river environment; and 4) glochidia and juvenile mussels may not be found using the sampling protocols described. However, the following level of take of these species can be anticipated by dredging and relocation of 10,890 square feet of substrate constituting suitable mussel habitat; an additional 10,890 square feet adjacent to the dredge and disposal sites could also be disturbed by settling sediment and sand. Thus, mussels occurring over a total of 21,780 square feet of river bottom could be incidentally taken as a result of the proposed action. The scope of the proposed experiment has been reduced from that of the previous experiment. Approximately one-half of the river bottom area and one-tenth of the substrate volume of the 2002 experiment will be affected. Consequently, the potential for any of the federally listed mussel species addressed in this biological opinion to occur in the proposed dredge area is low. Nonetheless, it is possible that individuals of each species may exist in the dredge and/or disposal sites and could be incidentally taken during implementation of the proposed experiment. For the proposed action, any incidental take would likely be in the form of harm (as indicated in the table below) because of direct mortality during dredging and disposal. Take may also be in the form of harass and/or collect due to displacement during those activities.

SPECIES	# INDIVIDUALS	TAKE TYPE	CH* DESTROYED
Pink mucket pearly mussel	1	HARM, HARASS, COLLECT	N/A
Orangefoot pimpleback	1	HARM, HARASS, COLLECT	N/A
White wartyback	1	HARM, HARASS, COLLECT	N/A

SPECIES	# INDIVIDUALS	TAKE TYPE	CH* DESTROYED
Fanshell	1	HARM, HARASS, COLLECT	N/A
Ring pink	1	HARM, HARASS, COLLECT	N/A
Cracking pearly mussel	1	HARM, HARASS, COLLECT	N/A
Rough pigtoe	1	HARM, HARASS, COLLECT	N/A

*CH - Critical Habitat

EFFECT OF THE TAKE

In the accompanying biological opinion, we determined that this level of take is not likely to result in jeopardy to the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, or rough pigtoe, or result in the destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes that all reasonable conservation measures for the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, and rough pigtoe have been included in the project description. Therefore, the Service has not identified any reasonable and prudent measures that would further minimize the level of incidental take.

TERMS AND CONDITIONS

Since the Service has not identified any reasonable and prudent measures to further minimize take of the affected species, there are no terms and conditions. However, in order to be exempt from the prohibitions of section 9 of the Act, the Corps of Engineers must implement the proposed action as identified in the "DESCRIPTION OF PROPOSED ACTION" section of this biological opinion.

If any dead, injured, or sick specimens of endangered or threatened species are found during the proposed action, initial notification must be made to the nearest Service Law Enforcement Office (Mr. Steve Middleton, 150 Trademark Business Center, 220 Great Circle Road, Nashville, Tennessee 37228; telephone 615/736-5532). Care should be taken in handling sick or injured specimens to ensure effective treatment and care, and in handling dead specimens to preserve biological materials

in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The conservation measures that are part of the proposed action are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, we anticipate that no more than one individual each of the orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, pink mucket, and rough pigtoe will be incidentally taken, or a total incidental take of seven individuals. If, during the course of the action, more than one individual of the pink mucket, orangefoot pimpleback, white wartyback, fanshell, ring pink, cracking pearlymussel, or rough pigtoe occurs, such incidental take represents new information requiring review of the action. The Corps must immediately provide an explanation of the causes of the taking and review with Service biologists the need for possible modification of the proposed action or reinitiation of consultation.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service believes that this provision of the Act places an obligation on all Federal agencies to implement positive programs to benefit listed species, and a number of recent court cases appear to support that belief. Agencies have some discretion in choosing conservation programs, but section 7(a)(1) places a mandate on agencies to implement some type of program.

We offer the following conservation recommendations for consideration:


1. The Corps should implement a long-term study of the effects of dredging on freshwater mussels. Experiments such as the one addressed in this biological opinion should be conducted, but long-term monitoring (i.e., minimum of four years) should be done to determine if relocated mussels survive for more than one year and reproduce. Studies should also be done to determine how long it takes mussels to re-orient themselves in the substrate after being removed and subsequently returned to (dumped in or otherwise released) the river environment, and what types of events would move them into unsuitable habitat before that time elapses.
2. The Corps should seek opportunities to assist, and take an active role, in efforts reintroduce freshwater mussels within their historical ranges. Efforts to reverse the

effects of adverse impacts to riverine habitats and to restore those habitats are succeeding in some areas. It is unlikely that mussels will re-colonize those areas naturally; therefore, reintroduction of adult mussels and propagated juveniles of species that historically occurred in those river reaches is probably the only way to restore those populations.

In order for us to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes consultation on the action outlined in the consultation request. As provided in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take specified in this biological opinion is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion, (3) the agency action is subsequently modified to include activities that cause an effect to the listed species or critical habitat not considered in this biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation of consultation.



Lee A. Barclay, Ph.D., Field Supervisor

11-13-03

Date

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ATTACHMENT: Previous Biological Opinions Completed by the Cookeville Field Office for the Seven Endangered Mussels Addressed in the Biological Opinion for the Corps' Proposed Mussel Dredging Experiment.

SPECIES	YEAR	INCIDENTAL TAKE NUMBER
Pink mucket	1987	Take not anticipated
Orangefoot pimpleback; White wartyback; Rough pigtoe; Ring pink; Fanshell; Pink mucket; Cracking pearlymussel	1990	17 individuals inclusive of all species
Orangefoot pimpleback; Pink mucket; Ring pink; Fanshell; Rough pigtoe; White wartyback	1991	60 individuals inclusive of all species
Orangefoot pimpleback; White wartyback; Fanshell; Rough pigtoe; Ring pink; Pink mucket; Cracking pearly mussel	1991	Not able to determine
Orangefoot pimpleback; Rough pigtoe; Pink mucket	1992	Incidental take not anticipated with implementation of RPA
Orangefoot pimpleback	1993	Not able to determine
Rough pigtoe; White wartyback; Cracking pearly mussel; Fanshell	1993	No take authorized
Orangefoot pimpleback	1993	No take authorized
Pink mucket	1993	Not able to determine
Pink mucket	1994	Not able to determine
Pink mucket; Fanshell; Rough pigtoe	1994	Not able to determine
Pink mucket	1994	Not able to determine
Pink mucket; Rough pigtoe; White wartyback; Orangefoot pimpleback; Cracking pearlymussel; Ring pink; Fanshell	1996	Six individuals each species over and above 30 allowed for "rescue"

SPECIES	YEAR	INCIDENTAL TAKE NUMBER
Cracking pearly mussel; Fanshell; orangefoot pimpleback; Pink mucket; Ring pink; Rough pigtoe; White wartyback	1999	Not able to determine
Pink mucket; Orangefoot pimpleback; Fanshell; Ring pink	2000	Not able to determine
Pink mucket; Orangefoot pimpleback	2001	Two individuals of each species
Pink mucket; Orangefoot pimpleback	2002	No take anticipated

-----Original Message-----

From: Kitchel, Lisie [mailto:Lisie.Kitchel@dnr.state.wi.us
<mailto:Lisie.Kitchel@dnr.state.wi.us>]
Sent: Wednesday, November 05, 2003 1:00 PM
To: 'Broach, Joy I LRN'
Subject: RE: Comments?

Sorry - I thought the time period for comments had closed - since it was during our busy field season I had not received any comments from our staff, since all were too busy - if there is still time for comments we could still provide them, but what I heard from folks can be summarized as;

- 1) The devil is in the details and this EA provides no details - where is the work plan? protocols? what procedures have been put in place to address the data gaps? what and how will the new QA/QC address past problems and by whom?
- 2) Could we get a copy of Appendix A since it contains the evaluation of the 2002 "experiment"? Without seeing the previous results it would be ridiculous to proceed with another "experiment" that could be flawed or improved, or impossible to provide comments without the data.

Comments specific to the EA include;

- 1) It is assumed that moving dredged material creates new habitat, how is this justified? will the dredge spoils be placed in areas NOT already habitat for mussels? Its no increase in habitat if it is already habitat. Conclusions that the resulting effect of dredged materials for mussel habitat will increase mussel populations is erroneous, unless spoils are placed ONLY in areas that are not already suitable. Extrapolating this to endangered species is just as erroneous if assumptions of new habitat are not valid.
- 2) There is no discussion of impacts to mussels at the disposal site, what impacts on the existing population of mussels from deposition of materials on them? Will this be evaluated and how? for all species? for all sizes?
- 3) Although "all sizes of mussels" are discussed in the potential relocation of the bed, how will this be evaluated at the disposal site, as well as the existing population of "all sizes of mussels" at the disposal site? Could the juvenile mussels that occur at the disposal site differentially succumb as compared to the adults that might be able to move up through the spoils deposited on top of them?
- 4) There was no account of state listed species - I realize the Corps and F&WS are both federal agencies, but were there no state listed species of concern in the area? especially, since you also were required to get state authorization for this project?

5) Alternative analysis was minimal - do it or not....are there other options?

Could constant (annual) maintenance of accumulating shoals prevent mussel beds from getting established and therefore not be a problem? This could be costly, but an option compared to divers moving mussels.

6) Although the clam-shell will remove mussels to a depth of 1 foot - will there be an evaluation for mussels at the dredge site after this removal?

7) There was no mention of zebra mussels - are they not an issue at this location?

8) The Environmental Safeguards Section should reference the work plan or protocols of how this specifically is going to be done - without a reference to the specifics this is just a vague accounting of what might be done. The details do not need to be in the EA, but they should be referenced in the EA to provide accountability for this proposed action. This information may have been provided in Appendix A but that was not attached to the EA, nor referenced in this section.

that's my quick read and two cents -
thanks for the opportunity to respond,

Lisie Kitchel
WDNR/Bureau of Endangered Resources
101 S. Webster
Madison, WI 53707
(608) 266-5248 phone
(608) 266-2529 fax

-----Original Message-----

From: Joy.I.Broach@LRN02.USACE.ARMY.MIL
[mailto:Joy.I.Broach@LRN02.USACE.ARMY.MIL]
Sent: Monday, November 24, 2003 9:03 AM
To: Kitchel, Lisie
Subject: RE: Comments?

Dear Ms. Kitchel,

I have applied for water quality certification in Tennessee. You can find a copy of the experiment's public notice at the following website:

<http://www.state.tn.us/environment/wpc/wpcppo/arap/>
<<http://www.state.tn.us/environment/wpc/wpcppo/arap/>>

It is the first notice listed (NRS03-278) under the November 18, 2003 date.

The new comment period ends December 19, 2003. I can use your email to address comments, or you can formalize them via letterhead.

1. Many of your questions regard the protocol. The EA contains all the appendices except the 404(b)(1) evaluation, which is a separate .PDF file. You can access these documents at:

http://www.lrn.usace.army.mil/pmgt/Environmental/public_notices.htm
<http://www.lrn.usace.army.mil/pmgt/Environmental/public_notices.htm>

They are found under the second listing (PM-P-03-02).

2. Data from a one-year monitoring of the first experiment is under review. The local resource agencies (USFWS, TWRA, USGS, TVA) are reviewing this data as well as analyzing data from the first experiment. They will have final say regarding release of specific information as this is their area of jurisdiction. They have over-seen the entire process providing questions, modifications, and site selections.

EA Questions

1. Regarding New Habitat. I referred to the disposal process as habitat creation. I was corrected. The process is more accurately referred to as habitat expansion. The EA addresses this observation. The original substrate behind Diamond Island (the back chute) was mud. Six of the seven disposals performed over the last 50 years placed a mixture of gravel, cobble, and sand over the substrate. No further disposals can be placed there due to the large mussel population (as per TWRA).

2. The experimental area is located in a one-mile reach of river permitted for sand and gravel extraction. It was assumed that few mussels would be found in this highly disturbed area. The first experiment revealed more than a few resident mussels. The protocol for the second experiment will address effects of this procedure on mussels in the disposal area.

3. Re: all sizes of mussels. One-quarter meter quadrats will be collected and sieved through a series of sized screens. Mussels will be measured. A histogram on size can be generated to give an idea of the size make-up. If the disposed material spreads in a layer of a few inches, then migration through the substrate would not appear to be a problem.
4. The State and Federal list of endangered or threatened mussel species are the same. The state list can be found at the Tennessee Wildlife Resources Agency (TWRA): <http://www.state.tn.us/twra/nong001.html>
<<http://www.state.tn.us/twra/nong001.html>>
5. The alternatives for this experimental procedure was to do the experiment or not. As for maintenance dredging at a site that has shoaled, your suggestion of annual maintenance as an alternative at a site in need of maintenance dredging will be considered. Thank for this idea.
6. The protocol for this second experiment describes post-dredging and disposal assessment.
7. One zebra mussel has been found.
8. The protocol is now part of the EA. For the first few days of posting, Appendix A was not included in the .PDF file. We corrected this oversight as soon as we realized it. I am sorry for the inconvenience this may have caused you or others that may have accessed the documents during the first few days of posting.

The goal of this experiment is to determine if this method can be used to remove large populations of mussels prior to necessary maintenance dredging. A lot of time, money, and effort has gone into developing this project. If you or other malacologists think that there is additional information that might be gained during implementation of this project, please let me know. All suggestions/questions would be considered.

I appreciate your responses and hope I addressed your questions. Please feel free to contact me.

Sincerely,
Joy Broach

U.S. Army Corps of Engineers - Nashville District
P.O. Box 1070 (PM-P)
Nashville, TN 37202-1070

Phone: 615-736-7956 Fax: 615-736-2052
Joy.I.Broach@lrn02.usace.army.mil

Freshwater Mollusk Conservation Society

Richard G. Biggins, Chair
Environmental Quality and Affairs Committee
55 Pyfrom Drive
Swannanoa, NC 28778

November 26, 2003

Lt. Colonel Byron Jorns, District Engineer
Nashville District Corps of Engineers
P. O. Box 1070 (PM-P)
Nashville, TN 37202-1070

Dear Colonel Jorns:

On behalf of the membership of the Freshwater Mollusk Conservation Society (FMCS), I submit these comments on Public Notice PM-P 03-02, dated July 31, 2003. The FMCS is a professional organization devoted to the advocacy for, public education about, and conservation science of freshwater mollusks, North America's most imperiled fauna.

The work proposed by your agency involves the experimental use of dredging equipment to relocate freshwater mussel populations from an area in the Tennessee River, Hardin County, TN, with the intent to expand the use of the technique to relocate possibly hundreds of thousands, if not millions, of native freshwater mussels from areas which may be dredged for improved navigation. We understand that the work has not been done yet this year, due to water conditions and funding constraints.

The Environmental Assessment (EA) does not contain sufficient information to fully evaluate the impacts of the proposed work. Based on an experiment begun in 2002, there are at least 22 species of native mussels in the proposed test site, including two federally listed species, *Cyprogenia stegaria* and *Lampsilis abrupta*. By any definition, this is a species-rich site. It is also possible that several other federally listed species may occur in the area. It is not clear from the EA how large an area was sampled to develop the species list - was it only the 2002 test area or the entire reach which may be affected by subsequent full scale dredging? There is no discussion of collecting time (diver-minutes), number of quadrats searched, area covered, the number of juvenile mussels that will be killed (juvenile mortality will likely approach 100%), or what other species might be present in the larger area. Even though the proposed work is experimental and purportedly affects a small area of the riverbed, perhaps there is a better place to test this technique that does not potentially affect so many species, including listed animals.

The proposed methodology is not sufficient to scientifically evaluate the experimental relocation technique. There is only 1 experimental site (replicates are needed), no control or reference site, no long-term monitoring, and no evaluation of the impact on mussels other than immediate death.

There is no identification or discussion of any alternatives. Some logical alternatives include: 1) collection of all animals by hand and relocation to suitable habitat, possibly offsite; 2) collection of all federally listed and proposed candidates by hand and relocation to approved propagation facilities, while using the experimental dredge on common animals; and 3) possibly shifting the channel and correcting erosion/deposition problems which affect the navigability of the site. There may also be "operational" alternatives worth considering to help minimize the need for future dredging, e.g., managing water release schedules from upstream dams during lower flow periods to increase water levels in problematic reaches of the Tennessee River. These and other possible non-dredging alternatives need to be examined in detail.

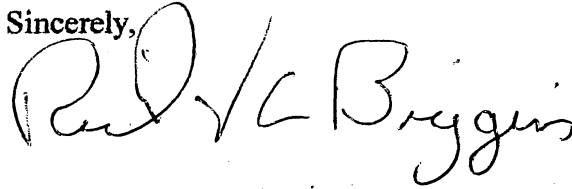
There is no adequate discussion of costs, time involved, resultant mortality of mussels under any alternative treatments; e.g., relocation by hand. The conclusionary statements, with no detail, provide no basis for a true comparison of techniques. When considering the true "cost" of this technique to relocate mussels in comparison to other techniques, the replacement cost of all mussels killed by the technique (short and long term) must be taken into account. The American Fisheries Society has just published "Investigation and Monetary Values of Fish and Freshwater Mussel Kills." These guidelines should be used to assess compensation for all mussels lost under the various alternatives. Attached is an example of how the guidelines could be applied to the small sample of mussels collected in 2002.

Also missing is a discussion of the proposed relocation site - what is already there; what is the anticipated impact of dumping sediment there; what is the impact of placing additional animals in an area already occupied by mussels. Or, conversely, if the proposed relocation sites are already un-occupied, there is a strong presumption that the habitat is unsuitable. There is no science supporting the presumption that the dumping of sediment and mussels into unsuitable habitat would somehow make the site then suitable. In addition, monitoring is required for several years to determine long-term survival.

Beyond the experimental phase, there will be a major action undertaken by your agency which will affect large mussel beds in the Tennessee River. That action should require an Environmental Impact Statement, must evaluate alternatives, and provide mitigation for lost animals, both adult and juveniles. At a minimum, all animals lost should be replaced by propagation and re-introduction into suitable habitat, off-site if necessary. Long-term loss of suitable habitat by Corps action (e.g., continued periodic maintenance dredging) should be offset by Corps activities in the basin to rehabilitate, restore, or re-create habitat capable of sustaining populations of native freshwater mussels. The Corps should have a goal of at least "no net loss" of mussels or their habitat in the planning and operation of its projects.

I would appreciate a response to the concerns expressed in this letter. Feel free to contact me if you require more information. Our organization stands ready to assist you in developing a scientifically sound experimental design and working towards the ultimate goal of mussel conservation efforts throughout the basin.

Sincerely,

A handwritten signature in black ink, appearing to read "R. G. Biggins". The signature is fluid and cursive, with the first name "Richard" and last name "Biggins" clearly legible.

Richard G. Biggins, Chair
Environmental Quality and Affairs Committee
Freshwater Mollusk Conservation Society

Attachment

cc: Ms. Joy Broach, U.S. Army Engineers, Nashville, TN
Mr. Gary Myers, Tennessee Wildlife Resources Agency, Nashville, TN
Mr. Don Hubbs, Tennessee Wildlife Resources Agency, Camden, TN
Mr. Daniel Ferry, Tennessee Valley Authority, Norris TN
Dr. Lee Barclay, U.S. Fish and Wildlife Service, Cookeville, TN
Mr. Brian Cole, U.S. Fish and Wildlife Service, Asheville, TN
Ms. Patricia Morrison, U.S. Fish and Wildlife Service, Parkersburg, WV
Dr. G. Thomas Watters, The Ohio State University, Columbus, OH

Sample Application of American Fisheries Society Guidelines for the Valuation of Mussel Kills

Taking the numbers of mussels reported in Table 1 of the EA, 1720 individuals of 22 species were reported from the 2002 test site. Assuming they were all adults (no data to indicate otherwise), assuming they are all killed in the experiment, and ignoring the five (5) endangered individuals, look up the replacement costs of each species using Appendix F - Replacement Costs of Juvenile Freshwater Mussels. There were 8 animals in the \$0.44 group, 1615 in the \$0.73 group, and 92 in the \$9.63 group. Assuming the 9.5% survival rate to adult would require raising 18,053 juveniles to replace the 1715 individuals all at once. If there are age composition data, then the numbers are segregated by age and the differential survival calculated for each age class from age 1 to age 5+.

Under this scenario, the production costs to replace 1715 adult mussels amount to \$21,780, if the required 18,053 juveniles were produced all in one year, plus the costs for transportation, stocking/transplanting, and monitoring. If the production and stocking occur over multiple years for multiple year-class stocking, then add recurring costs, such as labor, management, facilities operations and other expenses directly related to raising and stocking mussels. The annual costs can then be reduced to present value.

Expansion of the number of mussel affected in the experimental dredging to those potentially affected by the actual maintenance dredging should be similarly calculated.



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

REPLY TO
ATTENTION OF

May 18, 2004

Project Planning Branch

Mr. Richard G. Biggins, Chair
Freshwater Mollusk Conservation Society
Environmental Quality and Affairs Committee
55 Pyfrom Drive
Swannanoa, North Carolina 28778

Dear Mr. Biggins,

This is in response to your letter dated November 26, 2003, regarding Joint Public Notice PM-P 03-02. This notice contained information about the proposed mussel relocation experiment.


The U.S. Army Corps of Engineers, Nashville District, (Corps) recognizes the serious concerns regarding Diamond Island because a large mussel population has colonized sediment that has shoaled into the navigation channel. The U.S. Army Engineer Research and Development Center in Vicksburg, Mississippi developed and conducted the initial experiment on September 17, 2002. This experiment was a first attempt to evaluate an alternative mussel removal method that might relocate mussels in a more timely, efficient, safer, and economical way than handpicking by divers. In response to comments about what was done the first time, the Corps is making plans to conduct a carefully designed second experiment that will provide quality data about this possible new mussel relocation method. Your comments have been considered in the redesign of the original protocols and the revision of the 2003 Environmental Assessment (EA), (here to referred to as the 2004 EA) for this second experiment.

We would like to request the Freshwater Mollusk Conservation Society (FMCS) to provide a list of six scientists from the Guidelines and Techniques Committee who could review the enclosed redesigned protocols and field layout for scientific soundness.

We appreciate this opportunity to establish a working relationship with the FMCS and welcome your input in this

endeavor. I am forwarding a copy of this letter to Dr. Tom Watters, President, Freshwater Mollusk Conservation Society, c/o Museum of Biological Diversity, Aquatic Ecology Lab, The Ohio State University, 1315 Kinnear Road, Columbus, Ohio 43212-1394. If you have any questions or comments, please contact Ms. Joy Broach at (615) 736-7956.

Sincerely,


w/ Byron G. Jorns
Lieutenant Colonel
Corps of Engineers
District Engineer

Enclosures

PROPOSED REDESIGNED EXPERIMENTAL PROTOCOLS

An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging

Introduction: The purpose of this document is to describe a standard operating procedure for this experimental method in relocating mussels using dredging equipment. The performance of scientific evaluations and the collection of quality data would be necessary in order to evaluate mussel mortality associated with action of the clamshell bucket dredge. The Tennessee Wildlife Resources Agency (TWRA) would be performing quality control checks. The Malacologist In Charge (MIC) would be a scientist from a government organization. General conditions for this experiment are as follows:

A. Sorting process: Quadrat and clamshell bucket samples would be washed through a series of stacked screens sized 3, 1½, ½, and ¼-inch openings.

B. All mussels encountered would be:

• Identified.	• Measured by screen grouping. If time allows, some mussels would be measured with calipers.
• Counted.	• Checked, and general condition noted (includes abnormalities, cracks, chips, broken shells).
• Maintained in good health.	• Kept together per sample in tagged bags until returned to the river.
	• Handed over to the TWRA for care and relocation outside the test sites unless used for mark and recapture.

C. All **listed species** would be removed from the samples and handled separately. State and Federally listed species would be individually identified, counted, measured in length, aged (height and wet weight optional), and checked for general and reproductive (sexed) condition. Listed species would be handed over to the Tennessee Wildlife Resources Agency once data has been collected.

D. Quality Assurance/Quality Control (QA/QC) – A subset of the activities (as noted) would be redone to check for accuracy. TWRA would be filming underwater conditions. Filming would be a separate and independent action occurring when equipment and contract divers are out of the water.

E. The MIC (from a participating agency) would determine completion of an activity, and help develop a rating system to indicate level of injury, damage, or impact. The MIC would hand over all live animals not used for mark and recapture, to TWRA for care and relocation outside the test footprints.

F. TIME. The length of the experiment would be a total of 3 days, from start to finish.

G. As time allows, the next task can be initiated and completed regardless of Phase.

H. Contract divers must meet U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), Section 30 – Contract Diving Operations. All standard safety protocols related to field and barge work would be followed. (Safe diving advises river flows between 20-30 thousand cubic feet per second.)

I. CONTINGENCY PLAN: In the event something happens that would affect the Phases or Tasks of the experiment (weather, equipment failure, injury, illness), a meeting of the agencies represented on site, would determine the course of action. They would document reasons for deviations and modifications.

J. A pre-meeting would take places to discuss objectives and purpose of the study, as well as logistics, would be held with key personnel prior to fieldwork

K. A safety meeting with divers would be held each day.

L. At the end of each workday, key personnel would meet to review the day's activities and plans for the remainder of the study.

M. A follow up meeting, to include all key personnel, would be held at an appropriate time after the field study has been completed and data have been analyzed.

PHASE I - Task I – Documenting Site locations and Existing Conditions		Resources Agency QA/QC
CORPS		
1) Site selection	The purpose of this task is to delineate the dredge removal and placement sites. Coordinates would be recorded using a global positioning device (GPS) in a format useful to all agencies so that sites can be relocated accurately in subsequent years on printed maps.	TWRA would select test dredge and placement sites. Optimally, a placement site with few mussels. The experiment would take place within the same general area used for the September 2002 study, possibly moving either immediately upstream or downstream of the previous experimental locations.
2) GPS Coordinates	The Corps would log GPS coordinates for all site locations in Degree, Minute, Second, using Datum 1983. Points would be identified on a digital USGS Topographical Map. CONTRACT DIVERS: Divers would verify test dredge and disposal locations with the MIC. Divers would note ease of relocating the test sites above and below the water.	
a) Survey Area	The Corps Survey boat would conduct a bathymetric survey to map the existing bottom at the dredge and placement areas.	
b) Boundary Marking	The Corps would mark dredge and placement site boundaries, and scow disposals lines with appropriate temporary marking (example: PVC, chains, floats, etc.) for easy relocation above and below water CONTRACT DIVERS: Divers would secure up to 3 chains/cables/ropes (provided), or other appropriate markings across the original substrate in the test disposal area, running horizontally with the riverbank.	
c) QA/QC	A subset of the GPS coordinates would be rechecked with a second GPS unit. QA/QC would be coordinated with a participating agency.	After the test dredge and placement sites have been marked, TWRA would videotape the sites underwater to document existing conditions.

PHASE I - Task II – Preliminary Evaluation – Quadrat Sampling in Removal and Placement Sites.		Resource Agency QA/QC
Preliminary 0.25 square meter Quadrats sampling – Estimating mussel density		
CORPS		
1) Quadrats		
a) Collection	The purpose of this task is to characterize density, evidence of recent recruitment, and relative species abundance, using quantitative methods, of mussels in the dredge and placement sites. CONTRACT DIVERS: Divers would collect 20 (40 total) substratum (0.25 square meter) quadrats at each of the two sites (dredge and placement sites). Material would be placed in a 5-gallon bucket, hoisted to the surface, and processed at an appropriate site.	

b) Sorting Process	<p>CONTRACT DIVERS: Each quadrat sample would be washed (using water pumps) through a series of stacked graded screens (See Note A). All mussels would be removed and maintain in good condition. All mussels would be given to the MIC for further processing.</p> <p>The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) Marking	The MIC would identify a subset of non-listed mussels for a mark and recapture experiment using battery operated dremel tools or similar device.	
d) QA/QC	CONTRACT DIVERS: A portion of the sieved material would be retained and re-sieved to indicate accuracy of that process and mussel picking efficiency.	
e) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE I - Task III – Preliminary Evaluation – Timed Searches in Removal and Placement Sites		Resource Agency QA/QC
CORPS		
1) Timed Searches		
a) Time	<p>The purpose of this task is to use qualitative collection methods to obtain information on relative species abundance and presence of uncommon (listed) mussel species.</p> <p>CONTRACT DIVERS: Four – 15 to 30 minute searches would be conducted in the dredge and placement sites. Divers would attempt to collect all live mussels without size bias, as it is difficult to discern endangered species underwater. Divers would hand mussels over to the MIC. Report results as catch per unit of effort (CPUE). This would allow before and after comparisons. All mussels would be hand over to the MIC.</p>	
b) QA/QC	MIC would compare results from different divers working in the same area to determine search efficiency.	
c) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C.)	TWRA would verify identifications, counts, and general condition of the mussels.
d) Marking	MIC would retain a subset of non-listed mussels for marking as in Phase II, Task IV.	
e) Completion	The MIC would consult with TWRA to determine task completion. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE II - Task IV – Clamshell Bucket Scoop Evaluation. Dredge bucket impact (inside)		
Clamshell Bucket Scoops – Full and Partial scoops		Resources Agency QA/QC
CORPS		
1) Seeding	<p>The purpose of this task is to examine recently dredged material to assess the number of mussels that are either damaged or killed. Assessment would be made based on a developed rating system. Results would be expressed as the number damaged or killed, compared with the total collected from each scoop.</p> <p>CONTRACT DIVERS: Marked non-listed mussels would be distributed within the test dredge area in a pre-determined pattern and density for mark and recapture.</p>	
2) Bucket Scoop		
a) Collection	1-3 partial scoops and 1-3 full scoops of bottom material would be collected with a clamshell dredge bucket in the removal area. Each bucket scoop would be placed on a flat barge one at a time. This material would be maintained in a wet condition.	TWRA would film the impact of scoop depressions noting partial or full scoop depression.
b) Sorting Process	<p>Before processing, and as the work proceeds, the dredged material would be carefully inspected and all living and recently damaged mussels would be removed by hand as they are observed. Each dredge bucket scoop would be considered a single sample. Sediments from the scoop would be continuously run through the stations.</p> <p>CONTRACT DIVERS: Dredged material would be carefully shoveled from the deck and placed on the top of a nested screen series and processed as in Phase I Task II above. The material would be hosed with river water to wash the sediment through the screens. Stacked screens would be set within a containment area to capture fine sediment washed through the screens. Full screens with washed sediment would be separated by screen size and carried to respective sorting tables. Mussels would be picked from screen trays. Mussels would be maintained in good health. Mussels would be carried to the MIC sorting table for further processing.</p> <p>MIC would identify, count, size by screen groups (measure individually as time allows), note condition and marking and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	CONTRACT DIVERS: A portion of the sieved material would be examined for mussel picking efficiency and washed fines would be sub-sampled using a tray with 1/8 inch mesh to determine small mussel recovery.	
d) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material.	TWRA would take possession of all mussels not used in the experiment and relocate them outside the test footprints.

PHASE II - Task V – Bottom Evaluation – Quadrat Sampling in Dredged Site. Dredge bucket impact (outside)			Resources Agency QA/QC
CORPS			
1) Post-dredged 0.25 meter Quadrats and Timed Searches			
a) Collection	The purpose of this task is to use quantitative methods to assess the number of mussels that remain or are injured on the river bottom below the bucket scoop depth. CONTRACT DIVERS: Divers would collect up to 8 – 0.25 quadrats out each test dredge scoop depression on the river bottom. Divers would describe all underwater conditions while samples are taken. Note partial or full scoop depression. Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing. Divers would conduct timed searches over the entire scoop depression after quadrats have been taken. Record as CPUJE for comparisons.		
b) Sorting Process	CONTRACT DIVERS: Each quadrat would be washed (using water pumps) through a series of stacked graded screens (See Note A.). All mussels would be removed and maintain in good condition and given to the MIC. The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)		
c) QA/QC	CONTRACT DIVERS: A portion of the washed fines would be sub-sampled to determine small mussel recovery.		
d) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material. TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.		
PHASE II - Task VI – Clamshell Dredge Removal Efficiency			Resources Agency QA/QC
CORPS			
1) Clamshell Dredge Scoop Samples			
a) Dredging	The purpose of this task is to study effects of full and partial bucket dredging and placement in the river. The clamshell dredge bucket would be operated according to normal procedures. Separate areas would be used within the test dredge footprint for full and partial bucket removals. Light scoops would be placed in a single layer in one dump scow containing water. The dump scow would be moved to the placement site and the material deposited. The scow would be returned to the dredge site and Full scoops would be placed in a single layer within a dump scow containing water. The dump scow would be moved to the placement site and the material deposited.		

b) Survey Area	On completion of the dredging, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the dredge area.	On completion of the dredging, TWRA would film the new bottom topography.
c) Bucket Evaluation	CONTRACT DIVERS: Divers would inspect the partial bucket and full bucket dredge areas. Four 15 to 30 minute timed searches would be conducted to evaluate dredge bucket removal efficiency and to collect any remaining and damaged mussels. Record as CPUE for comparisons.	
d) Completion	This activity would be complete when the dump scow disposals are complete and the scow is out of the area.	

PHASE III - Task VII – Dump Scow Placements - Post-Placement Evaluation (Within 48 hours) Quadrat Sampling		
	CORPS	Resources Agency QA/QC
1) Post-Placement 0.25 meter Quadrats		
a) Placement	Each time, the scow would align perpendicular to the bank. It would slowly open the hull and back up to disperse the dredged material in a thin layer.	
b) Survey Area	On completion of the disposals, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the disposal site.	On completion of the disposals, TWRA would film the new bottom topography.
a) Collection	<p>The purpose of this task is to use quantitative methods to obtain an estimate of density and to evaluate the new distribution patterns and condition of dredged mussels transported by the scows.</p> <p>CONTRACT DIVERS: Divers would collect twenty 0.25 square meter quadrats from the disposed material in the placement footprint. Using the chain/cable/rope, note depth of disposed material over the original substrate when collecting the quadrats. Note location and mussel position in the substrate especially for of any marked mussels collected.</p>	
b) Sorting Process	<p>CONTRACT DIVERS: Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing through a series of stacked screens (See Note A). Pick mussels out of screens and maintain in good condition. Hand over all mussels to the MIC.</p> <p>MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	CONTRACT DIVERS: A portion of the washed fines would be sub-sampled to determine small mussel recovery. The fines would be washed through a tray with 1/8 inch mesh.	

d) Completion	The MIC would determine when this task is complete.	TWRA would take possession of all mussels for care and relocation outside the test footprints.
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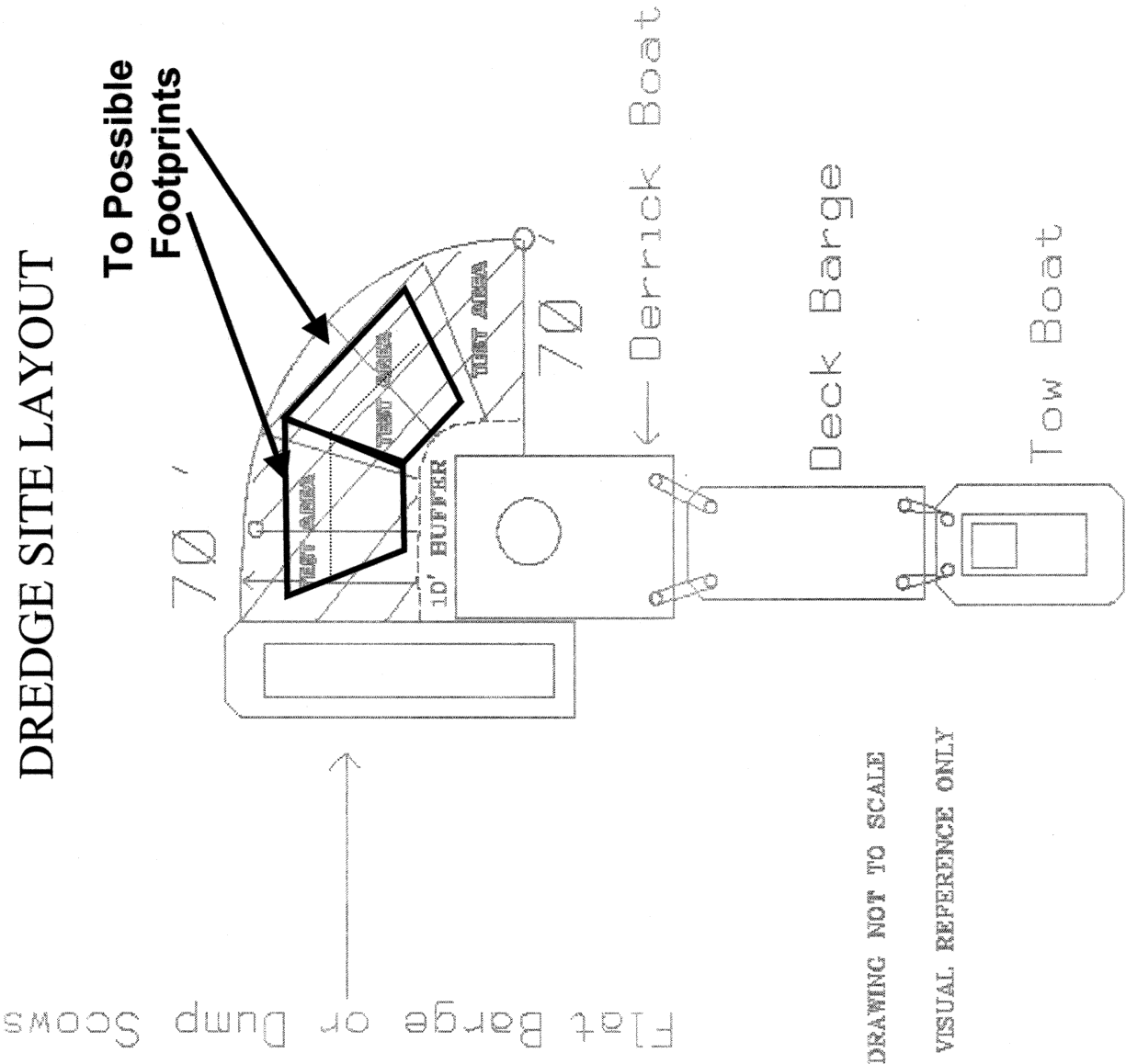
PHASE III – Task VIII – Dump Scow Placements - Post-Placement Evaluation (Within 48 hours) Timed Searches		Resources Agency QA/QC
CORPS		
1) Post Placement – Timed Searches		
a) Timed Searches	<p>The purpose of this task is to use qualitative methods to collect mussels from dredged material piles in the placement areas so investigators can examine mussel damage <i>in situ</i>.</p> <p>CONTRACT DIVERS: Divers would conduct four 15 to 30 minute searches over all the discernable disposed material. All mussels and freshly cracked, chipped or broken shells would be brought to the surface, as it is difficult to discern endangered species underwater. Record as CPUE for comparisons. All material would be given to the MIC.</p>	
b) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)	TWRA would verify identifications, counts, and general condition of the mussels.
c) Completion	The MIC would consult with TWRA to determine task completion.	TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.

PHASE III -Task IX – Documentation.		Resources Agency QA_QC
CORPS		
1) Data Reports	The MIC would generate the reports. All field data sheets would be put in electronic format. A progress report would be submitted to the participating agencies within 2 months of the field surveys. A final report summarizing the results of the whole project would be submitted to the participating agencies within 4 months. Within 30 days of report completion, all participating agencies would meet and discuss the project and major findings.	

<p>2) Success Criteria</p>	<ul style="list-style-type: none"> • Time – survival rate within 48 hours and 12-14 months later. • ~ % Survival in scoops examined in detail • ~% Removal efficiency – Comparison of pre post survey results • ~ % Mortality at the removal site • ~ % Survival at relocation site <p>The overall impact of this method is based on impacts to the mussel fauna. Negative impacts include mortality and significant shell damage. It may be possible that impact estimates may be species and size specific. Impacts would be assessed 1.) Dredge material within the bucket; 2.) Dredged material outside the bucket; 3.) And, dredged material placement. Some mortality and shell damage information may be obtained from the marked and replaced mussels. Some general information on efficiency of dredge bucket removal can be obtained by diver observations and sampling in the removal area after dredging has taken place.</p> <p>The impacts of the dredge on mussels in this method are obviously related to the percentage of mussels killed or damaged by this method. To put this into perspective, a comparison can be made with the percentage of mussels that are likely to be obtained by hand (collection efficiency) using divers.</p>
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CORPS CONTACT:
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U.S. Army Corps of Engineers
P.O. BOX 1070 (PM-P)
Nashville, TN 37202-1070

Phone: 615-736-7956 Fax: 615-736-2052
Email: Joy.I.Broach@lrm02.usace.army.mil



FIELD LAYOUT PLAN – Experimental Mussel Relocation Method – May 7, 2004

Bank DREDGE TEST FOOTPRINT

Test Buckets based on greatest concentration of mussels.

Bucket dredges in an arch.

Diagram not to scale.

1-3 full and 1-3 partial buckets will be dredged and processed on deck. When complete, ~15 full and ~15 partial buckets will each be placed in a dump scow and moved to placement site.

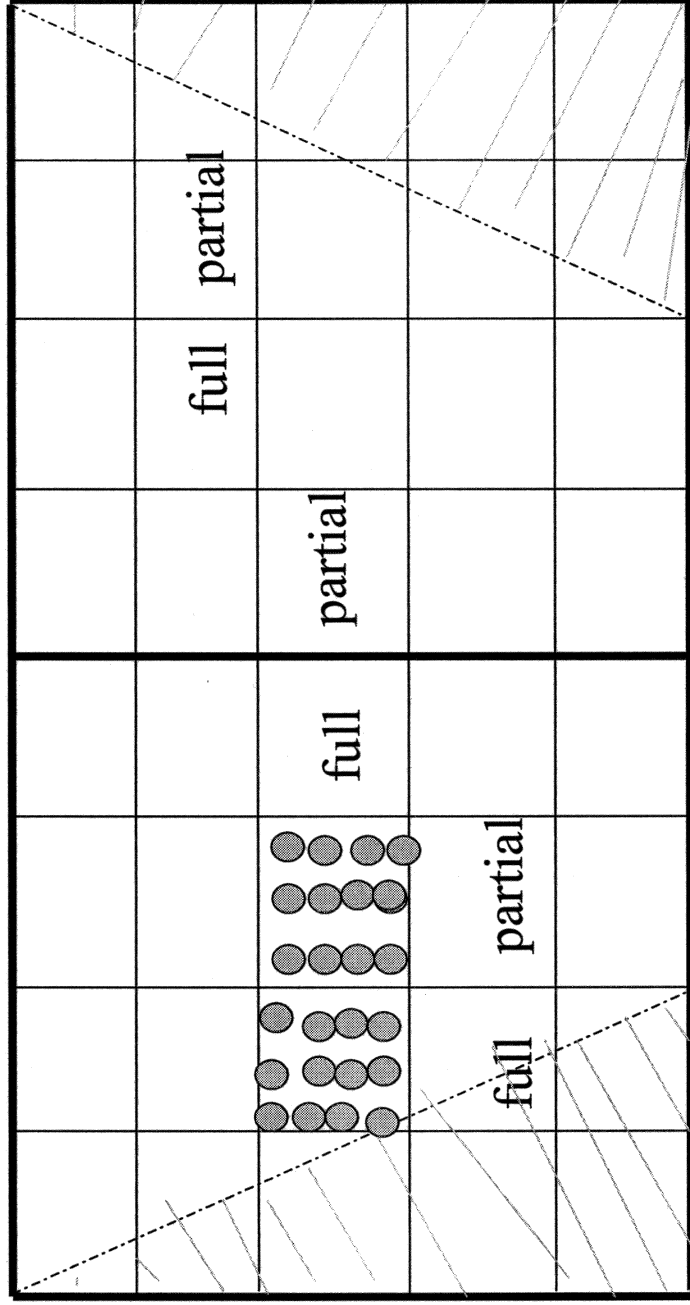
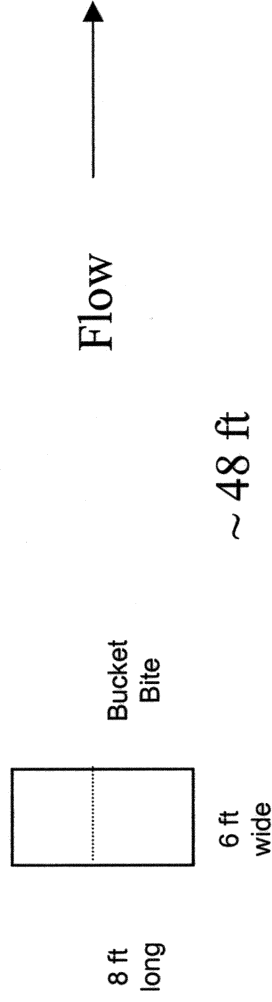
1 scoop ~ 6ft X 8ft ~ 48 sq ft.

30 scoops ~ 1440 sq ft

12 Marked Mussels per bucket

~ 360 Marked Mussels

~ 40 ft

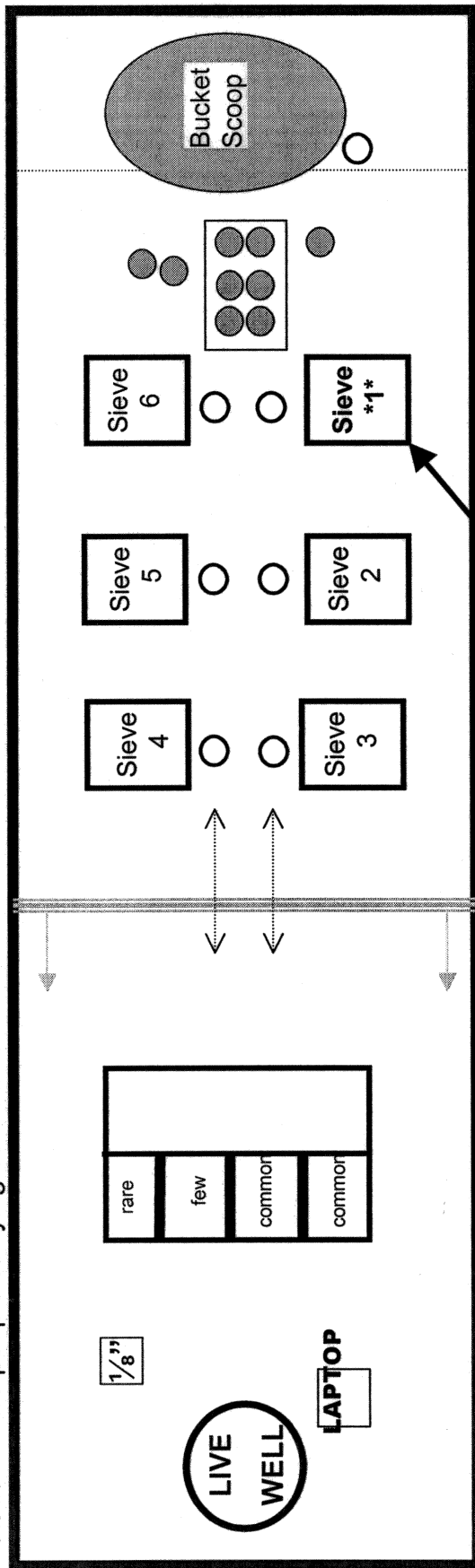


~ 24 ft.

FIELD LAYOUT PLAN – Experimental Mussel Relocation Method – May 7, 2004

BUCKET SIEVING AND SORTING

Bucket of material placed on deck. 6 sets stacked sieves. Shovel sediment into sieves and wash. Pick mussels and put in 5 – gallon bucket. Carry bucket to table. Malacologist identifies, and notes physical condition. Assistants, record species, condition, and length. Bag mussels and place in live well. Two people shoveling. Two people at each Sieve station. Two people carrying buckets to table.

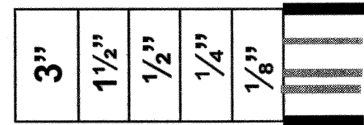


● = 5-gal buckets, substrate
○ = 5-gal buckets, mussels

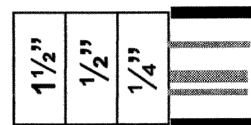
LEDGEND

Full Scoop ~ 600 gal / 5 gal = 120 quad
120 quad / 6 = 20 / Stacked Sieves
20 X 10 min = 200 min / 60 = 3.4 hr.


Partial Scoop ~ 300 gal / 5 gal = 60 quad
60 quad / 6 = 10 / Stacked Sieves
10 X 10 min = 100 min / 60 = 1.7



Stacked Sieves (SS)



Sieves 2 - 6

Water =  5-gal bucket=

Sieve *1*

-----Original Message-----

From: TNMussels@aol.com [mailto:TNMussels@aol.com]

Sent: Thursday, March 11, 2004 12:30 PM

To: Broach, Joy I; dave.mckinney@state.tn.us; Bill.Reeves@state.tn.us; Lee_Barclay@fws.gov

Subject: Comments on 2003EA Mussel Experiment

Joy, I have compiled my comments from yesterday's meeting and the EA in the attached Word file. Before we can proceed with another attempt of this method these areas of concern should be addressed.

No man ever steps in the same river twice, for it's not the same river and he's not the same man. -Heraclitus, philosopher (c. 540-470 BCE)

Don Hubbs, Mussel Program Coordinator

Tennessee Wildlife Resources Agency

POB 70

Camden, TN 38320

(731) 584-9032

email: Tnmussels@aol.com

Thursday, March 11, 2004

To: Joy broach, Project Manager USACE
From: Don Hubbs, TWRA

For clarification and documentation I would like to have a written response to the following points raised in yesterday's meeting and concerns I have detailed regarding the July 2003 EA before we proceed with the second attempt of this experimental mussel relocation method:

Specific points requiring a written response resulting from the March 10, 2003 meeting in Cookeville, TN with COE, USFWS, TVA & TWRA.

- 1) What is the status of the bathymetric survey noted in Corps EA (as annual) & SWPBA presentation, for work covering the proposed dredge area at Diamond Island? The experimental site (dredge and disposal areas)? Are they available? Can I get a copy of the surveys?
- 2) Who is responsible for calculating the 98.5% (18 visibly damaged of 1200 examined) survival rate presented for the first experiment in the SWPBA presentation? This is a gross misrepresentation of the data. It is irresponsible and unprofessional to publish such a statement based on a one time acute observation. Insufficient data were presented to calculate any value other than acute mortality.
- 3) 2003 EA makes reference that none of the endangered species encountered in the first experiment "were harmed" how was this determined? The 1-year monitoring report states that all mussels were "healthy and in good condition" is there analytical data to support this statement? Either provide sufficient data to support, or remove false, misleading statements from future reports.
- 4) Prior to release, any information products/reports produced from this second experiment shall be **independent peer reviewed by parties selected by the group i.e. COE/USFWS/TWRA/TVA**. This will be done in order to assure that the experiment and any future information products produced as a result of this experiment adheres to scientific principles, provides adequate documentation and references validating any theories espoused, produces creditable results without excessive, undocumented speculation and claims which occur throughout the 2003 EA and one-year monitoring report.
- 5) The EA specifies the time period for the experiment as early Fall (Sept. – Oct.) to avoid interfering with fish and mussel spawning activities. This should be adhered to. Definitely not during April – June.
- 6) Have the public comments regarding this experiment, both the failed first attempt and current proposal been adequately addressed? What has been done to address the concerns expressed in the Nov. 26, 2003 FMCS letter? If so, where?

Specific comments on the July 2003 EA

Section 1.3

- 1) A brief history of maintenance dredging frequency and extent surrounding Diamond Island for which this experimental method is being developed should be provided.

- 2) There are feasible alternatives to working in the river and they should be noted in the EA. Feasible alternatives include but are not limited to: increased minimum water elevations, reduction in the size and depth of commercial tow traffic etc.

Section 2.0

- 1) Provide specific citations where “moving communities and their current habitats” has been shown to expand mussel habitat and beds. Or remove this statement from the EA.
- 2) List the criteria and at what levels, will be used to judge the success of this relocation method so that it could be considered as a mitigation measure under NEPA, the Fish and Wildlife coordination Act, and considered a reasonable and prudent measure under the Endangered Species Act?

Section 2.2

- 1) Provide specific citations documenting the statement that during hand collecting “Several years of size classes are lost...” The current mussel sampling literature contradicts this statement. Or remove this statement from the EA.

Section 4.4

- 1) Replace “None of these endangered species were harmed by the experiment.” With -None of these endangered species appeared damaged by the experiment. Unless you performed before and after anatomical and physiological analyses on these individuals you cannot ascertain the degree to which they were or were not harmed.

Section 4.11

- 1) Provide specific citations documenting “Disposed material provided optimal mussel habitat as documented by the fact that continued disposals into the back chutes of islands has been prohibited because large mussel beds have developed in these areas.” If you cannot document the conditions existing in these areas prior to their use as spoil locations you cannot verify whether or not mussels were already in there and merely re-colonized or extricated themselves after being buried. Or remove this statement from the EA.
- 2) Provide specific citations documenting handling stress experienced by mussels during traditional methods of relocation, and explain how these stressors could be proven to be reduced in the proposed experimental method. Or remove this statement from the EA.
- 3) Provide specific citations documenting how “This method minimizes mussel stress...” How will mussel stress levels be measured prior to, during and after relocation by this method? Or remove this statement from the EA.
- 4) Edit the sentence “Sustaining these communities sustains commercial and recreational musseling...” Tennessee does not permit sport or recreational musseling, commercial harvest only.
- 5) The EA addresses the potential benefits of the experimental method over the use of divers but does not address the loss of the valuable mussel population information gained during large-scale relocation projects. Address this point in your discussion.

Section 5.0

- 1) Item 10. Have the dredge materials been tested for specific contaminant levels or is this just a guess. If analytical data are available provide the results. Or remove this statement from the EA.

Preliminary Section 404(b)(1) Evaluation

Page4. #4. You state “The dredge material would be loose and unconsolidated, making it easier for mussels to migrate through the material.” How do you justify this idea? Provide supporting citations or remove from the document.

Page8. #3. “Biota would be dislodged, relocated...” add and crushed to this sentence, as was documented in the first experiment.

Page10. f. Although this portion of the Tennessee River is operated as a reservoir under certain flow conditions the head of Diamond Island like other islands in this river reach has a large expanse of riffle habitat extending in a southwester direction, other areas around these islands can function as deeper pool habitats. Described how dredging operations can destabilize habitats and cause the loss of these important fish and mussel habitats.

Page 13. III. B. “..shoaling continues to lessen the width and depth of the navigation channel, barges eventually drag long the bottom, crushing the aquatic community.” Provide specific citations documenting how often this occurs and how much of the aquatic community is lost. Does not maintenance dredging increase the frequency and extent of this shoaling? Explain in more detail.

-----Original Message-----

From: Lee_Barclay@fws.gov [mailto:Lee_Barclay@fws.gov]
Sent: Friday, March 12, 2004 10:34 AM
To: TNMussels@aol.com
Cc: Bill.Reeves@state.tn.us; dave.mckinney@state.tn.us; Broach, Joy I
Subject: Re: Comments on 2003EA Mussel Experiment

Don,

I have reviewed your comments on the subject Environmental Assessment and want you to know that I concur with virtually every observation made and recommendations to correct problem statements. Jim Widlak and I will try to get comments on this draft document out as soon as possible. Thanks for your diligence.

Lee

Lee Barclay
Field Supervisor
Tennessee Field Office
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501
(tele. 931/528-6481, ext. 212)
(fax. 931/528-7075)

"Rare Species Protection: If not us, who...If not now, when?"

-----Original Message-----

From: TNMussels@aol.com [mailto:TNMussels@aol.com]
Sent: Thursday, March 11, 2004 12:30 PM
To: Broach, Joy I; dave.mckinney@state.tn.us; Bill.Reeves@state.tn.us;
Lee_Barclay@fws.gov
Subject: Comments on 2003EA Mussel Experiment

Joy, I have compiled my comments from yesterday's meeting and the EA in the attached Word file. Before we can proceed with another attempt of this method these areas of concern should be addressed.

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Don Hubbs, Mussel Program Coordinator
Tennessee Wildlife Resources Agency
POB 70
Camden, TN 38320
(731) 584-9032
email: Tnmussels@aol.com(See attached file: Dhubbscomments on 2003EA&data.doc)

May 21, 2004
Dear Mr. Hubbs.

Thank you for your comments and questions.

The scope of the 2003 Environmental Assessment (EA) now referred to as the 2004 EA covers only the scope of the experiment. All comments received have been considered, and the 2004 EA has been rewritten to clarify the impacts of the experiment alone. Alternatives regarding maintenance dredging are insightful, and would definitely be considered in a proposed maintenance dredging EA, however, they are beyond the scope of the 2004 EA for the second experiment.

Our responses are noted as **COMMENT** below and follow your outline.

Specific points requiring a written response resulting from the March 10, 2003 meeting in Cookeville, TN with COE, USFWS, TVA & TWRA.

1) COMMENT:

The Corps' 1975 Final Environmental Impact Statement, Open Channel Maintenance, Tennessee River and Tributaries, Kentucky, Tennessee, Mississippi, Alabama and Georgia, identified 15 sites where shoaling into the authorized channel has occurred. Approximately one-third of the sites are visited annually. As a result, sites may be surveyed on an average of once in three years. The last bathymetric survey performed in the Diamond Island area was in 2001.

A survey within the experimental site was performed in August 2002. The files are in PDF format for viewing and DGN for GIS import. This information was sent to you and Ms. Susan Lanier. If this format is not GIS friendly, I would ask that Ms. Lanier call Owen Traughber and find a way to transfer survey data electronically to you. Once we have found a method that works, we can share information.

2) COMMENT:

I calculated the estimated survival rate. The PowerPoint presentation given at the Southeastern Water Pollution Biologist Association (SWPBA) in October 2003 was the same presentation given at the 16th Annual Tennessee Rare Mollusk Meeting held in Knoxville on Dec. 3-4, 2003. In both presentations I explained how these calculations were made and why this estimate was inaccurate. There was no Quality Assurance/Quality Control procedure in place to verify the content of the excess sand and gravel tossed off the barge as the bucket scoop material was processed. One bag of mussels collected from the bucket scoop was not given to TWRA for identification and physical condition verification. And there was no method in place to evaluate the bucket scoops on the river bottom for remaining mussels. In both presentations I made this very clear.

3) COMMENT:

The endangered species noted were collected during the initial experiment in 2002. Empirical data was used to note these observations. The endangered species found did not appear to be physically damaged (shells were not broken, cracked, chipped, or scratched). All four Pink muckets (*Lampsilis abrupta*) were given to TWRA on site. The Fanshell (*Cyprogenia stegaria*) was collected a day after the initial experiment by TWRA. To date, no physical damage or ill health has been reported for these individuals.

Empirical data was also used during the 1-year monitoring. The mussels collected did not appear to have any obvious physical damage. No mussel was gaping or slow to close when disturbed. No putrefied smell was noticed. Some of the animals were gravid based on random checks.

A reference referring to mussel health is noted below:

Salazar, M., and S. Salazar. 2000. DRAFT Standard Guide for Conducting Field Bioassays with Marine, Estuarine & Freshwater Bivalves. 67 pp.

4) COMMENT:

A general procedure regarding data and information handling for the second experiment was provided during the March 10, 2004 meeting as follows:

- Raw data would be recorded on field sheets.
- Field sheets would be entered in a laptop.
- Electronic data would be given to the diving contractor to produce a field report.
- The report would be sent to USGS to review for accuracy and completeness.
- USGS would send the report to the participating agencies for review.
- USGS and the Corps would make the edits.
- Participating agencies would make the final review.
- The report would be sent out for peer review.

Consensus on this path would prevent any information regarding the second experiment from being released outside the group by anyone prior to release of a final report.

An EA follows a different path than the second experiment. It is a disclosure document that provides project background, alternatives, existing conditions, environmental consequences, and a conclusion regarding a proposed action. The EA must be reviewed by public officials, citizens and agencies prior to any decision or action. Comments are taken into consideration as the EA is finalized. The 2003 EA was made available for public comment per 40 CFR 1500 – 1508 Council on Environmental Quality NEPA Regulation, and Engineering Regulation 200-2-2. Your comments are considered as part of the public review process and will be fully considered as the 2004 EA is finalized.

Your email dated December 9, 2003 regarding the 1 year monitoring report stated: "General comment - The report is neat and concise, however it lacks sufficient discussion of the specifics of sampling procedures utilized, conditions encountered and relevance of the data gathered to produce meaningful conclusions regarding the fate of the initial experiment. Here are some suggestions for its improvement." Your comments associated with the initial 2002 experiment were forwarded to Dr. Miller. A final report is due late spring.

Your comments regarding the 1-year monitoring report will be re-visited.

5) COMMENT:

Comment noted.

6) COMMENT:

The results of the first experiment are still under review. Questions regarding the outcome of the initial experiment cannot be adequately addressed pending a final report and full assessment of all data associated with the first experiment. Participating agencies will be the first to review this report. Their comments and recommendations will be considered prior to public release for a full review.

Public comments, specific to the 2004 EA (2003 EA), consisted of two emails and one letter. You and Ms. Lisie Kitchel, Wisconsin Department of Natural Resources, Bureau of Endangered Resources responded with emails. The Freshwater Mussels Conservation Society (FMCS) provided the only letter. The FMCS is asking for specific details and results about the initial experiment. They have been informed by letter dated May 18, 2004, of the status of the initial experiment. Their comments will be considered during the review of the initial experiment and revision of the 2004 EA (2003 EA). We have also requested assistance from the FMCS to review the redesigned protocols and field layout for the second experiment.

Specific comments on the July 2003 EA

Section 1.3

1) COMMENT:

I will provide this information in the 2004 EA.

2) COMMENT:

There are two alternatives for this experiment. The proposed action alternative is to do the experiment. The No Action alternative is not to do the experiment. Feasible alternatives for maintenance dredging are beyond the scope of this 2004 EA.

The alternatives you have listed would be addressed with additional alternatives in a proposed maintenance dredging EA. The two alternatives you mention have been considered by TVA and are discussed in the 2004 Tennessee Valley Authority Reservoir Operation Study – Final Programmatic Environmental Impact Statement. The TVA ROS will be added to the references.

Section 2.0

1) COMMENT:

Supporting information is found in the following paper: Payne, B. S., R. Tippit, and R. M. Engler. 1989. Environmental Effects of Dredging. Technical Notes. This document was handed out during the March 29, 2002 interagency meeting held at the TWRA office in Nashville. The 2004 EA will cite the reference.

An analysis of all the TWRA and TVA mussel surveys overlaid with the Corps maintenance dredging sites over the last 50 years might yield additional information.

2) COMMENT:

A series of measurements have been defined for this experimental method by the participating agencies. The proposed redesigned protocols recommended measuring the following parameters:

Time – survival rate within 48 hours and 12-14 months later.

- % Survival in scoops examined in detail

- % Removal efficiency – Comparison of pre post survey results

- % Mortality at the removal site

- % Survival at the relocation site

This is an experiment involving many partners. Following data collection and analysis, the partners will objectively determine whether this method is a viable means of relocating mussels. Collaborative efforts determine if this can be considered in the future as a mitigation tool to minimize impacts.

Section 2.2

1) COMMENT:

Robert M. Anderson. 2000. Assessment of Freshwater Mussels in the Allegheny River at Foxburg, Pennsylvania, 1998, notes: "...not all species are equally susceptible to sampling visually because of size, color, or habits. *Villosa fabalis*...is small, rarely exceeds 38 mm in length (Parmalee and Bogan, 1998), and is not as visible to divers as are the larger species."

Strayer and Smith (2003) observed that detailed visual and tactile searches are limited in that these collection methods result in a biased sample of the population because small or deeply buried animals are missed.

Section 4.4

1) COMMENT:

Statement will be changed.

Section 4.11

1) COMMENT:

At the request of TWRA, the Corps sought alternative disposal sites that could benefit from placement of sand and gravel. The request was based on the quality of the mussel community occupying previous disposal areas.

2) COMMENT:

Cope and Waller (1995) acknowledged that handling may affect mussel survival "...and relocation adds an additional, and largely anthropogenic, set of stressors that affect mussel survival." The concept of stress is also observed by Dunn et. al. (1999) in noting that "The success of translocation appears to be dependent on reducing stress during collection, handling, and transport, and selecting suitable habitat." Other documents that address handling stress are also noted below and will be added to the 2004 EA references.

Cope, W. Gregory, and Diane L. Waller. 1995. Evaluation of Freshwater Mussels Relocation as a conservation and Management Strategy. Regulated Rivers: Research & Management, Vol. 11, 147-155.

Dunn, Heidi L., Bernard E. Sietman, and Daniel E. Kelner. 1999. Evaluation of recent Unionid (Bivalvia) relocations and suggestions for future relocations and reintroductions. Proceedings of the First Freshwater Mollusk Conservation Society Symposium, 1999, pages 169-183.

Salazar, M., and S. Salazar. 2000. DRAFT Standard Guide for Conducting Field Bioassays with Marine, Estuarine & Freshwater Bivalves. 67 pp.

Strayer, David L. and David R. Smith. 2003. A Guide to Sampling Freshwater Mussel Populations. American Fisheries Society Monograph 8. 103 pp.

3) COMMENT:

The experimental method is expected to be less stressful to mussels than removal by divers because the mussels are not individually handled, they would be maintained in a wet condition, and suitable habitat would be transported, with them. Empirical data, as described above, may be used to describe stress and health. Participating agencies may have other methods to capture this information and are welcomed to implement them themselves.

4) COMMENT:

The sentence will be edited to remove "and recreational."

5) COMMENT:

Collecting statistics on individual mussels by divers in populations of over one million mussels during a single event is not feasible. Dunn (1999) noted that a baseline inventory would "estimate the quality of the community with respect to density, recruitment, and species composition." Statistics deal with a subset of a population because it is not feasible to know the entire population.

Dunn (1999) provides sampling strategies to capture population statistics in Dunn, Heidi L. 1999. Development of strategies for sampling freshwater mussels (Bivalvia: Unionidae). In Proceedings of the First Freshwater Mollusk Conservation Society Symposium. 1999, pages 161-167

Section 5.0

1) COMMENT:

This assessment is based on EPA's 404 guidelines as follows:
Part 230:Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material,
Subpart G Evaluation and Testing, 230.60 General evaluation of dredged or fill material states:

“(a) If the evaluation under paragraph (b)* indicates the dredged or fill material is not a carrier of contaminants, then the required determinations pertaining to the presence and effects of contaminants can be made without testing. Dredged or fill material is most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material. Dredged material so composed is generally found in areas of high current or wave energy such as streams with large bed loads or coastal areas with shifting bars and channels.

*(b) The extraction site shall be examined in order to assess whether it is sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge material is not a carrier of contaminants.”

Further data collected by TVA in 2000 indicated that Kentucky Reservoir sediments were free of pesticides and PCBs. Metal concentrations were within background levels. This information is on the TVA website under “Reservoir ecological health.”

A 404(b)(1) evaluation was performed for this experiment and is an appendix in the 2004 EA.

Preliminary Section 404(b)(1) Evaluation

Page4. #4.

COMMENT:

Statement will be removed.

Page8. #3.

COMMENT:

This statement will be modified.

Page10. f.

COMMENT:

The impact to the benthic and fish communities in implementing the experiment is noted in section 4.2 of the 2004 EA.

Page 13. III. B.

COMMENT:

The Proceedings of the Marine Safety Council, April-June 2000, Volume 57, Number 2, contains information on “Bump and Go” groundings. Minor groundings can be reported with a phone call with no written follow-up. The definition is: “Bump and go” groundings – the touching of the bottom on the Western Rivers by uninspected towing vessels and uninspected barges in the navigational channel with no damage, no pollution, no personnel injuries, and no unintentional breaking apart of the tow.” The G-MOA Policy Letter 2-98 definition added that a vessel must receive “no assistance to resume voyage.” The Marine Casualties Natural Work Group (NWG) disagreed with “no assistance” because help from an additional towboat “serves to maintain the integrity of the river bottom in the channel during low water periods.”

Questions regarding maintenance dredging are beyond the scope of the 2004 EA.